Medical Lib AUG 19 1921

Volume III, No. 8 AUGUST, 1921 Old Series, Vol. XIX, No. 8

The Journal of Orthopædic Surgery

The Official Publication of the
American Orthopedic Association
and of the
British Orthopædic Association

ISSUED MONTHLY
FIVE DOLLARS PER ANNUM

372 MARLBOROUGH STREET
BOSTON, MASS., U.S.A.

For the
British Orthopædic Association

Editor
R. C. ELMSLIE, M.S., F.R.C.S.

Editorial Committee
T. R. ARMOUR, F.R.C.S.
W. H. TRETHOWAN, F.R.C.S.
H. PLATT, M.S., F.R.C.S.

For the
American Orthopedic Association

Editor
E. G. BRACKETT, M.D.

Editorial Committee
J. L. PORTER, M.D.
E. W. RYERSON, M.D.
R. B. OSGOOD, M.D.

CONTENTS

CONGENITAL HIP COMMISSION REPORT.
By Joel E. Goldthwait, M.D., Boston and Z. B. Adams, M.D., Boston.

LESSONS FROM MY EXPERIENCE WITH CONGENITAL DISLOCATION OF THE HIP. By John Ridlon, M.D., Chicago.

MANIPULATION OF STIFF JOINTS. By Sir Robert Jones, Liverpool, England.

FRACTURES OF THE ELBOW IN CHILDREN. By James S. Stone, M.D., Boston.

ARTHRODESIS OF THE SACROILIAC JOINT. A NEW METHOD OF APPROACH. By M. N. Smith-Petersen, M.D., Boston.

THE APPLICATION OF MUSCLE PHYSIOLOGY TO THE TREATMENT OF PARALYSIS. By Lennox G. Teece, M.D., Ch.M., Sydney, Australia.

For Complete Table of Contents, See Second Page.

IMPORTANT NOTICE.

THE Editor and the Editorial Committee of the Journal have under consideration the possibility of changing the Journal from a monthly to a quarterly publication. The larger volume, issued at longer intervals, would give certain opportunities for preparation not possible in the monthly publication, and would probably afford a larger total amount of material during the year. The Committee would be grateful for the expression of opinion of the subscribers of their attitude toward such a possible change,—first, as to whether it would meet their approval; second, if not, as to their reasons for preference for the continuation of the monthly publication.

Please address communications to the Editor, Dr. E. G. Brackett, 166 Newbury Street, Boston, Mass.

VOL. III, No. 8 AUGUST, 1921 Old Series Vol. XIX, No. 8

The Journal *of* Orthopædic Surgery

REPORT OF COMMISSION ON CONGENITAL DISLOCATION OF THE HIP

BY JOEL F. GOLDTHWAIT, M.D., BOSTON.

THE COMMISSION appointed to consider the subject of the treatment of congenital dislocation of the hip desires to report progress and to request more time in which to complete its work.

Your Commission has made some progress in its study, but that which is presented at this time must be considered entirely in the nature of a preliminary report, since much more time will be necessary before the real significance of all the features of the investigation can be presented. The anatomic study, as far as it has been carried, is undoubtedly exact, but there is much that is yet to be completed, in order that the correct interpretation of these anatomic findings may be possible.

The vote which created the Commission reads, "To investigate the best method of reduction of congenital dislocation of the hip by a study of end results of at least three years' duration; these results to be collected in several large clinics for the Commission and observed by them, looking to a standardization of methods and the secondary changes which may occur following attempts at reduction."

From this it is evident that the whole subject of Congenital Dislocation of the Hip is under discussion, since, while the best method of treatment is desired, this is to be decided by the study of the end results, and to analyze these fairly it is necessary to have a reasonably exact knowledge of underlying anatomic conditions. What we have a right to expect must depend to a considerable degree upon the structure of the joint at the time of treatment, and since one

finds such structure varying from what might be called normal (except for the displacement) to marked distortion or imperfect development of the bones, the results must vary accordingly.

Some of the differences in the anatomic structure in these conditions will be shown in the slides which will be presented, and an attempt is being made to see whether or not there is any constancy in these variations from normal which should influence the prognosis. Such information is essential before opinions as to results of treatment can be properly formed, and it is quite obvious from the literature on the subject, as well as from the differing opinions of those who have had reasonably large experience with such cases, that such information is very far today from what could be called exact.

The decision as to the best method of treatment is to be reached, according to the vote of the Association, by study of the end results. This is naturally in keeping with that which should be expected of an association of orthopaedic surgeons, since the thing for which we stand fundamentally is the test of function, or end results, and in this special subject your Commission is conscious that if its report is to be complete, it must judge the results upon a much longer basis than a three year period. What finally becomes of these cases we should know, not three years after our care, but thirty years or more, and we, the members of our Association, should determine this and not have the information thrust upon us from outside. That we, as a body, are not able to speak with exactness upon this today is apparent from the different opinions held by theoretically equally good men.

In beginning its work, your Commission has first sought the opinion of the members of the Association, and on October 4th of last year a circular letter was sent out, from which a limited number of replies has been received. It is evident at once that we, as a body, are not in touch with our cases, so that it is possible for us to have more than indefinite impressions as to the real results of our work. Histories are incomplete, x-rays were not taken, or have been destroyed, subsequent examinations have not been made or records entered, etc., so that it is impossible to pass fair judgment upon such work.

Several of the members have sent in reports of carefully prepared cases. These have been studied. Others have been sent in that are lacking in many of the details desired by the Commission, but which

have some value in certain phases of such a study and are being used as much as is possible.

The Commission has visited several of the Eastern clinics this year, with the expectation of extending its study to the other sections during the coming year, if that is desired by the Association.

A most carefully prepared group of forty-nine cases was examined at the New York Orthopaedic Hospital and Dispensary, and we are indebted to Dr. Hibbs, not a member of this Association, for the time, interest, and courtesy shown by him and his entire staff in the study.

A group of eight cases from the Johns Hopkins Hospital was studied at Baltimore, through the kindness and interest of Drs. Baer and Bennett.

At the Children's Hospital, Boston, twenty cases were actually examined, while the radiographs before and after of an added sixty-two cases were studied, the work being directed by Dr. Soutter.

From the Massachusetts General Hospital, eighteen cases were studied, representing the work of the Orthopaedic Department of that Hospital.

Attempts have been made to see cases in other of the Eastern clinics, but for one reason or another such opportunity has not been possible.

To form an opinion of the best methods of treatment in such cases is naturally not easy, unless other observers or clinics are willing to submit their work for analysis.

The statistical study, as far as the work has been carried, will be presented by Dr. Adams, and the lantern slides which are offered as suggestive evidence at this time will be presented by Dr. Willard. From the former, suggestive conclusions may be drawn, but nothing definite can be stated that would represent our final opinion until other groups of cases have been studied. From the latter it will be seen that very few of the hips are normal in their bony form, either before treatment or after treatment. An anatomic normal is rarely seen: nevertheless, from the point of view of function many of the cases are normal. How far these two features depart is surprising.

The anatomic structure with reference to replacement and with reference to its permanence is suggested. The relatively vertical or the widely oblique axis of the innominate bones certainly has some importance in the function of some of the hips. The depth of acetabulum, the prominence especially of the upper shelf, is of suggestive importance as to late prognosis. The axis of the neck, both vertically

and anterior-posteriorly, is of wide significance. The shape of the neck of the femur varies greatly, and while no real conclusions can be drawn from this at the time, it, nevertheless, is strongly suggested that the long slender neck rarely stands the strain of treatment and usually shows later with much shortening and distortion.

The inclination of the axis of the epiphyseal cartilage joining the head of the femur is apparently of much importance in the final result. The cases in regard to this feature group themselves under three types: one, with the axis nearly horizontal, the lower border of the neck of the femur projecting inward, so that it must be well within the joint and completely underlying the epiphysis; two, with the axis oblique, the diaphysis being largely without the joint and nothing to hold the epiphysis in place in its relation to the neck of the bone other than the strength of the cartilage itself; and three, the crescentic form convex upward, so that the epiphysis fits on to the neck of the bone as a cup.

The change in the development of the bone from that which existed before treatment and that which exists after treatment offer very suggestive matters of reflection upon which as yet the Commission does not wish to submit a final opinion, but enough has been shown to lead us to warn all who have the care of such cases to use the least amount of violence that is possible in whatever treatment is considered necessary, since the capital epiphysis of the femur, like any other similar bone structure, may be very easily damaged, with resulting serious interference with its development.

In the slides which are presented the selection has been made in order to show first the widely differing conditions present in these cases, and secondly some of the conditions as they exist after treatment is ordinarily completed. One slide is presented to show a case long after ordinary care with one hip still unreduced, with much disability, and with the other hip, which was never displaced but which had some of the anatomic features seen so commonly in these cases, which must mean strain with use. The disability in this imperfectly formed, but never actually displaced, hip is greater than in the dislocated one. The anatomic appearance of some of the hips here shown suggests the possibility of strain with resulting irritative thickening, with a similar end result.

Your Commission regrets that it is not able to report more fully at this time, but is ready to continue the work if it is desired, and hopes that the members of our Association understand enough of the difficulties of the problem to enable them to have patience with its

representatives. It wishes to express its appreciation to all who have assisted by offering cases for study, and trusts that the Association appreciates enough of the effort which this represents to be genuinely grateful to them.

STATISTICAL REPORT OF THE COMMISSION ON CONGENITAL DISLOCATION OF THE HIP, FOR 1921.

BY Z. B. ADAMS, M.D., BOSTON.

THE COMMISSION wishes to thank the members of the American Orthopedic Association for their kind coöperation in this work on congenital dislocation of the hip. We hope that it will stimulate the members to the keeping of more complete and careful data on just what was done in each case, and to the following of the cases from the time of reduction until the ultimate end-result is obtained—so that we may improve our methods of treatment and after-care.

The Commission would welcome any suggestions as to improving their card for recording the cases.

STATISTICS.

As to sex, 1056 cases were collected, of which number 116 were boys and 940 were girls. As to hips dislocated, 713 cases were collected for study (474 Denucé and Papin); 201 were right (115 Denucé); 288 were left (108 Denucé); and both were out in 224 cases (251 Denucé). See Denucé.

The presence or absence of other congenital defects was recorded in 234 cases, and found in 14 of that number as follows: spina bifida, spina bifida occulta, absence of tibia, genu recurvatum, pes equinovarus, pes valgus, idiocy, etc. Some of these hips showed extreme defects before reduction, but the results in general were satisfactory. Seven were in, one was questionable, five were out, and two were

anterior. Good function was recorded in six, fair function in three, poor function in four, and one was questioned in regard to function.

Although inheritance is infrequent—194 cases recording only seven instances where dislocated hips existed in some other member of the family—the condition seems to occur more frequently in certain races. In southwestern France—the Basque country— with a population of less than five millions of people, 875 hips have been reduced in one clinic at Bordeaux since August, 1914, while in the two largest orthopedic hospitals in New York City, which are surrounded by a population of approximately fourteen millions of people, only 535 hips have been reduced during the same period of time. Furthermore, we are told that congenital dislocation of the hip is not common among the negroes. Dr. Baer, in Baltimore, says that the proportion is about one colored child in thirty children with congenital dislocation of the hip.

Fully realizing that the soft parts, *i.e.*, the muscles and their tendons, the capsule and ligaments, the joint and bone cartilages which do not show in radiographs, may play an important rôle in the difficulties of reduction, a study of the radiographs of the hips before reduction has been attempted—with a view to determining the best method of treatment and the ultimate prognosis as to final result. Of the 102 hips thus studied, 71 showed torsion. Small, osseous centres in the capital epiphyses were noted in 60; this centre was imperfect in 2, missing in 3, and good in 21. A shallow socket was noted in 13, a poor shelf in 17, and a fair shelf in 30.

These pre-operative defects, with the exception of torsion, seem to have but little effect upon the result.

METHODS USED IN REDUCTION.

Ridlon's method, 348; Lorenz's method, 150—of which Lorenz himself did 38 while in this country; open method 12, one of these by Hoffa himself; manual, 155 (?)—many of these Ridlon's method; Bradford machine, 80; Hibbs table, 80; and preliminary osteotomy was done on 11 femora. These figures include the replacements as well as the first operations. The Commission would like to have recorded. also, whether the cases were reduced easily or with difficulty, whether or not much force was used, and whether the hip went into a good acetabulum or not. Upon these facts, which we believe to be of importance, almost no data has been returned.

The machine and Hibbs table methods may be used gently, although these methods usually mean force; hips may be broken by manual manipulation.

It was suggested in my paper of last year that many of these deformed heads resembled Calvé-Legg's disease and might be due to trauma.

POSITION.

Lorenz position was used after 188 reductions, Lange position after 140, mid-position after 7, Schlessinger position after 2, and Worndorf after 1. It was our hope to be able to report the influence upon torsion of these positions, but there have been too few radiographs submitted to allow any such study. However, torsion is found after Lorenz's position, as well as after Lange's position.

The length of time after reduction the patients remained in the primary position and plaster varies greatly. In some clinics the plaster is changed routinely at the end of one month; in others, the hip remains in the primary position and plaster for four or more months. In a few, this first plaster is continued for eight months, all plaster below the knee being taken off at the end of four months. Plaster is the only method of holding of which we have any records, although I am told that some operators employ a splint. The plasters, in some reports, are described as spicas; in a very few others, we are told that they extended from the ribs or the waist to the knee, below the knee, to the ankle, or to the toes. In general, but little attention was paid to this query, and no statistics can be given for comparison.

We believe this matter may be of importance, and may be the cause of some of the deformities noted, and the cause of lost function. We should like to know how long the plaster was left capping the knee—thus bringing pressure on the superior femoral epiphysis—but this fact was not supplied in answering our questions. In short, the details have not been supplied. Some sort of spica was continued, in general, on an average of from seven to ten months,—the time varying in inverse ratio to the age of the child.

The children walk in from two to ten months. In some clinics, they are encouraged to walk early in plaster. In other clinics, no walking is done until after the plaster is taken off. In still other clinics, it is the practice—after a considerable period of recumbency—to allow the child to walk, wearing a plaster spica. But here again, the data is not accurate enough to allow of any report. It is thought that this small detail may influence the results—especially when the child is

gotten on its feet soon after the removal of the plaster, when it has been held for a number of months, or when it is gotten on its feet, wearing a heavy plaster, after months of recumbency and the accompanying atrophy.

As to post-operative treatment, the data returned is so scanty that no report can yet be made. If it is the routine to give active and passive exercises, nothing is said about it. Limbering exercises were recorded in a few cases, but no notes of their character, or success were given: yet this may be a very important period in the treatment, as regards deforming or shaping the head softened by long holding in the plaster.

RADIOGRAPHS.

The changes which are so commonly found by a radiographic study of these hips are not due to rickets, for this condition was noted only four times in the 209 cases studied. They may be due to congenital defects in the head and acetabulum, which may or may not have caused the dislocation. Some of these hips, occurring with other congenital defects, give as good results as the general case under our treatment. Are all of these defects purely congenital?

Some of the changes, such as fracture of the neck, are due to known violence. Is it not possible that the cartilaginous head may be crushed by force used in reduction, or that stretching and pulling the capsule may destroy the circulation in part of the head and neck? Is it not also possible that the weight bearing too soon after long confinement in plaster may crush the sotfened head?

RESULTS.

For analysis, the cases were divided into those over six and those under six years of age. Of the children *six years of age and over,* there were 46 cases, 14 of which are double (60 hips); 70 operations and replacements; 24 hips are in, 29 are out, 1 is marginal, and 6 are questionable. Of the 14 double cases—three cases done by machine have one hip in and one hip out; another case has both hips in, but one head gone. Done on the Hibbs table, one case, six years of age, has both hips in, with fair function; there is one case in which both hips are questionable, and one case in which one hip is in and one hip is questionable. Of those done by Dr. Stern's method,—he reports one case, 11 years of age, in which both hips are in, with good function; also one case in which one hip is in and one hip is out. In all the other double cases—five in number—both hips are out. Of the single hips, two right ones are out, and five left ones,—making a total of seven failures out of thirty-two single cases.

	CASES	HIPS	MAN.	MACH.	H.T.	LOR.	OP.	OUT	IN	MAR.	ANT.	?	GOOD	FAIR	POOR	?
J.H.	8	12	12					2	10				3	2	3	
C.H.	59	76	24	63			1	13	54	9		13	29	17	8	2
MGH	18	25	14	2			5	4	20	1			7	14	5	
Hibbs	49	63	13		85	1	1	16	47				23	22	4	
Stern	74	91	109				1	19	71	2			54	7	13	
Freiberg	8	9	9						7				4	4		
Hodgdon	1	2	2						2				1 CURED			
Mayo	42	58	12		45		1	16	26	9		5	19	7	11	5
Steindler	15	19	19					3	11		1	4	7	2	6	
Campbell	3	3							3				2	2	4	
Brackett	9	12	14				4	5	5	1	1		2	2	4	
	286	370	228	65	130	1	13	78	256	22	2	12	149	67	54	7
Ridlon + others	439	412	446						152		32	14	42			

COMMISSION EXAMINED 8 BALT. + 49 N.Y. + 29 C H = 86 CASES 113 HIPS

NORMAL MOTION IN 14 RED. HIPS

CASE	SEX	AGE	DATE	HIPS		X-RAY	RX	POSITION	HELD	1ST COMM. WALK	IN PLASTER	MASS	X-RAY	MOTION	SHORT	RESULT
7 MW	♀	2	1915	BOTH	NO	NONE	MANIP	LANGE	LONG SPICA	1 MOS	4 MOS	6 MOS	L	F IN R	NOR	G
5 SL	♀	3	1918	LT	RICKETS	ST P	HT I FAIL	"	S	"		3"	L	F IN R	NOR	G
17 ML	♀	4	1903	LT	NO.	NONE	MANIP	"	S	"		5"	NO	T IN P	NOR	G
5 MA	♀	3½	1918	RT	CONGEN.	SDT P	HT I FAIL	"	"	"	1 MOS	6"	NO	I F IN RF	NOR	G
16 IOC	♀	2	1906	LT	DEF.	S P	MANIP	"	"	"	?	9"		N IN N	NOR	G
12 AM	♀	2	1910	RT	NO	S G	HT	"	"	"		5"	L	G VIN	NOR	G
6½ BH	♀	3	1917	RT	PREVIOUS	SVT G	MANIP I FAIL HT	"	"	?		4"	L	T S VIN G	NOR	G
15 AV	♀	2	1907	BOTH	RX	ST F	MANIP	"	D	"		6"		N IN G	NOR	G
						ST F	MANIP OSTIOT							K OUT F	LAX	G
8 JOH	♂	2	1914	LT		ST P	HT	"	SPICA	"		7"		G T IN R	NOR	G
8 LF	♀	3	1912	RT		NONE	MACH	?	"	"	3"	3"		NONE	NOR	G
6 DW	♀	2⅓	1915	BOTH		NONE	MANUAL MANUAL	LORENZ	D		10"	16"	L	F IN G	NOR	G
7½ AP	♀	4½	1917	LT		ST SP	MANUAL	"			9"	9"		N IN ? N	ROT. IN -	F
8½ FTC	♂	2¾	1917	BOTH		NONE	MACH MACH	MID	D	?	?	?		T IN RF N IN RF	LT NOR	F T RES
20 HH	♂	2½	1913	BOTH		S S	MACH	LANGE	SPICA	5"	10"	6 8"	L	N IN R F IN R	NOR LIMITED	F LIMP

F = FLAT NS = NECK SHORT V = COXA VARA

DEFORMITIES IN RADIOGRAPHS

		BEFORE								AFTER							
B HIPS	CLINIC	A	T	G	S	SS	P	F	G	N	G	D	T	N	R	G	F	P
5	E	4	5	2	2	1	3	2				4	4		4	1	1	2
33	N	43	24	4	29		19	9	5	4	4	35	24	N	23	9	8	12
8	B	9	3	4	4		1	6	1			9	5			3	4	2
12	M	21	12	4	8		3	2	5		1	18	8		9	14	2	5
2	H	2	2					2				2			2	2		
7	F	10	6	2	5		3	3	1	1		8	7	N	1	4	4	2
3	C	3	3		3		1	1	1			3	1		1		1	2
	S	8								1		7	5		4	6	2	
34	H	62	16	1	18	4	25	5	4	6	5	51	23		6	21	16	17
104		162	71	21	60	5	55	30	17	12	10	137	77		50	60	38	42

HEADS

G = GOOD = 21
S = SMALL = 60

SS = IMPERFCT = 5
T = TORSION = 71

N = NORMAL = 12
D = DEFORMED = 137

GOOD = 10
T = TORSION = 77

ACETABULA

G = GOOD = 17
F = FAIR = 30

P = POOR = 55

G = GOOD SHELF = 60
F = FAIR " = 38
P = POOR " = 42

R = ROUGH = 50
N = NORML = 2

Ridlon's records show that 110 cases—31 doubles—(141 hips), *six years of age and over,* were treated by him and other surgeons. One hundred and forty-one operations and re-operations were done by Ridlon, Lorenz, and others; 30 hips were reduced; 11 were failures; 12 are anterior; 21 single hips are out and short. Fourteen double hips were attempted and resulted as follows: one case with one hip in, and one anterior; ten cases with one hip in and one hip out; three cases with both hips out. Three fractures were recorded. The final total results in children over six years of age are 201 hips, 219 operations, and 54 hips in.

Of the children *under six years of age,* there were 250 hips (195 cases; 55 double, 311 operations performed with the following results: 198 hips were in, 34 were out, 12 were marginal, 4 were anterior, and 2 were questionable. There is good function in 118 hips, fair function in 48, poor function in 26, and questionable function in 3. These include the 55 doubles. Of the latter, 40 cases have both hips in, six cases have one hip in and one hip out, three cases have one hip in and one hip anterior, and six cases have both hips out. Of the single hips out, seven were right and six were left—making a total of 13. Reports on 36 of these 195 cases were made very soon after the plaster was removed and hence are not, perhaps, reliable.

Ridlon adds a record of 271 hips—219 cases—62 double—*under six years of age,* with 305 operations and replacements being done by him and others. Of these hips, 122 are reduced, 59 are out, 10 are marginal, and 25 are anterior. Of the 62 doubles, 15 cases have both hips in, 17 cases have one hip in and one hip out, 9 cases have one hip in and one hip anterior, and 7 cases have both hips out. Of the single hips out, 9 are right and 26 are left. This makes a grand total of 722 hips, with 835 operations, and 374 hips in.

Now, Gentlemen, we must compare these results with those reported by M. Le Docteur Edouard Papin, of Bordeaux, who reports in a recent article on 725 hips done since August, 1914. They have reduced every hip with only 11 re-dislocations, and of these re-dislocations, nine were re-reduced. He uses the simple manual method of M. le Professeur Denucé, and puts much emphasis upon the fact that no force ever is used in the reduction.

ATROPHY AND SHORTENING.

Atrophy is noted as present in a good many thighs and legs which anatomically are reduced, and have been reduced for a number of years. Shortening is present in a good many of the reduced cases—even in some where the heads are very good, but it is not always accompanied by atrophy.

TRENDELENBURG.

The presence or absence of a Trendelenburg sign has been studied in some cases. It is found present in cases that are anatomically reduced, where the glutaeus medius muscle is weak, as it is in some of the cases. There is not yet enough data to give any figures. These children limp. And gain, Trendelenburg's sign is absent in certain cases which are out by radiographic evidence, but where the muscles are strong, and the child has learned to incline the body a little to the affected side.

Chart 4 shows 14 hips with normal motion found in the examination of 113 hips. All others showed certain limitations of motion, the most frequent being increase of outward rotation and diminution of inward rotation.

LESSONS FROM MY EXPERIENCE WITH CONGENITAL DISLOCATION AT THE HIPS.

BY JOHN RIDLON, M.D., CHICAGO.

In 1885, Dr. Buckminster Brown of Boston, reported (*Boston Medical and Surgical Journal*, 1885, No. 23) a case of bilateral congenital dislocation of the hips treated by traction, and cured. The cure, however, proved to be a delusion. Dr. Brown did not know whether the hips were replaced or not.

Trusting in Dr. Brown's report, I treated a unilateral case by traction, believed that I had replaced the hip, and reported the case in the *New York Medical Record*, November 16, 1889. I know now that I never replaced the hip at all. I have record of two other New York cases—one unilateral and one bilateral. The unilateral case was the first anterior dislocation reported. These cases were not treated.

Treatment by traction after the method of Buckminster Brown, or by traction splint, as I did prior to 1892, and as is still being done by some advertising orthopaedists and orthopaedic institutions, is absurd and always results in failure.

In June, 1892, I came to Chicago, and from that time to December, 1900, I attempted to replace dislocated hips by the following method: "The leg was pulled by assistants against the resistance from a towel through the crotch held by the operator as a preliminary stretching. Then the operator stood at the side of the patient away from the dislocated hip, flexed the thigh on the pelvis, wound his arm around the thigh from the front to the outer side, back and inner side and outwards across the groin. Grasping it thus, he adducts, flexes and lifts the head of the femur towards the acetabulum, and rotates it from side to side while he holds the pelvis down with the other hand." (Ridlon and Jones, 1899.) Obviously, only a very easily reducible hip could be reduced in that way.

The state of knowledge in this country late in 1900 may be understood by the following notes made by me when, with the mother of a 4-year-old girl with bilateral congenital dislocation of the hips, we consulted the three then most eminent orthopedic surgeons in New York City and received the following advice:

Dr. Shaffer advised Bradford's operation at about the age of five years. If the bloodless operation relapsed, do an open operation. If that relapsed, use the traction splint with surcingle about the hips. The best result in unilateral cases is one inch shortening.

Dr. Gibney advised the bloodless method—one hip at a time. The child to walk after one week; but very little. Operate on the other hip two or three weeks later. Put in plaster splint with 120 degrees to 130 degrees abduction, rotated inwardly. Leave it so for six weeks; then rotate it a little and put on a short spica. Put felt back of the trochanters. After two or three months, put on a brace like Whitman's and use massage and passive movements. Suffer relapse three or four times before resorting to an open operation. Use traction splint if necessary, after failure.

Dr. Whitman said he had 25% successful in unilateral cases. He advised stretching by hand, and abduction to nearly a right angle. Put up rotated inward. He said relapses usually are forward. He said there should be no stiffness by the bloodless method; none by the open method unless the socket is scraped out. He tried bloodless replacement but once.

In the autumn of 1900 Dr. Bradford kindly loaned me Lorenz's new book, and from that time on I attempted to follow his method, using a specially built table with a post between the patient's legs plugged into the table for a fixed point of counter-traction, and a

wedge-block plugged into the table for a fulcrum to pry the femoral head into the socket.

Lorenz should not be credited with originating the "bloodless" method of successfully replacing congenitally dislocated hips. To Paci of Pisa belongs the credit. Lorenz learned the "bloodless" method from Paci at the International Medical Congress in Rome in 1894, and published his book in 1895. (See paper by Dr. G. G. Davis, *American Medicine*, August 29, 1903.)

Lorenz's method, modified from that of Paci, as demonstrated in this country in 1902-3 was as follows: The patient being fully anaesthetized, the capsule was stretched by fully flexing the straight leg until the foot was beside the ear, then strongly carrying the leg backwards, and from side to side; then a sheet folded obliquely was passed between the legs and fastened to the head of the table, the perineum being protected with a rubber pad and two or three assistants pulled on the leg, each bracing a foot against the table. When the stretching was deemed sufficient, the flexed knee was grasped by the operator, the thigh flexed to a right angle and abducted, the tense adductor muscles hacked off with the edge of the operator's hand, and the thigh strongly abducted over a wedge-block used as a fulcrum below (back of) the neck of the femur, while the opposite side of the pelvis was held down by an assistant.

The Lorenz operation is unnecessarily difficult and dangerous. Stretching the capsule by extreme bending of the thigh in all directions and strong traction of the limb as a preliminary to replacement, and abducting the thigh from right-angled flexion over a wedge-block while the adductor muscles are hacked off by the edge of the operator's hand, resulted in not a few fractures of the neck of the femur and several cases of paralysis. Even death has resulted. Hacking off the abductor muscles removes an important support to the replaced head, and has caused many "anterior transpositions."

On March 3, 1904, I reported to the New York Academy of Medicine (*Jour. Am. Med. Assoc.*, April 16 and 23, 1904) on the result of Lorenz's operations and my own cases up to that time. Soon after this report, Mr. Ralph W. Bartlett, a Boston lawyer, wrote me that he thought that all uncured cases could be cured by the use of his machine. I invited him to come to Chicago and try, and he accepted the invitation. In the *Chicago Medical Recorder* for September, 1905, I reported the results in Chicago with the Bartlett machine—four unilateral and three bilateral cases—and said as follows: "A year ago I reported on the results of 94 congenitally dislocated hips operated by

the manipulation method. Twenty-nine were replaced by Lorenz and 65 by me. I expressed the opinion at that time that the number of anatomical replacements from this method would not be more than 10% to 20%; that the number of failures in selected cases should not be more than 20%; and the remaining 60% to 70% should be what are called "good" results by Lorenz, and included all those cases where, despite the fact that a normal anatomical replacement does not result, the patient stands straighter and walks better than before the operation, the anatomical relations being such that the patient may be expected to gradually improve with the passing of years instead of gradually growing worse, as is the case in unoperated patients."

The use of Bartlett's (patented) machine and the Bradford machine is based on the mistaken theory that when traction is made on the limb the dislocated head passes downwards and back of the socket and can be pried in by a lever from behind; whereas it is only those more backwards than forwards of the middle of the socket that go that way. Further, pulling with the leg abducted pulls against the stretched adductor muscles, while pulling with the leg adducted, to relax the adductors, hooks the head against the rim of the socket, if there be any upper rim. All these bloodless methods, and all others that I know of, are executed without any attempt by the operator to determine at any stage of the manœuvre in just what relation the head really is to the socket. The plea I make for my operation is that the head is put in in the easiest way, with the least possible damage, and with positive knowledge at each step of the relation of the moving head to the fixed socket into which one attempts to put it.

Dr. Z. B. Adams, in his unpublished paper, "Analysis of the End Results of 32 Cases of Congenital Dislocation of the Hip, Comprising 42 Hip Joints," read at the last meeting of the Association in Toronto, seems to me to be even more pessimistic than I was 17 years ago. Apparently, Boston is still in the 1905 stage of development in the treatment of congenital dislocation of the hips. Adams's cases are divided into those over six years of age and those under that age. Of the 16 cases over six years of age—19 hips—all were out. One, a girl of 6½ years, was said to be anterior with two inches shortening, which is considerably more shortening than I have seen with a true anterior transposition. At least eight of these cases ought never to have been attempted, as they were from 13 to 16 years old. There were 16 cases—23 hips—under six years of age. Of these, it is said that there are 13 hips in, 2 anterior, 1 ankylosed and 7 out. This means that of the cases under six years, taking both

unilateral and bilateral cases together, over 60% were in. But the division of the cases at six years, without considering the shortening (which is not stated) is arbitrary. Taking all the cases together, there are over 30% in. My remembrance of the paper was that Dr. Adams claimed only 10% in; but I find no such statement in his paper which he recently kindly let me read. His conclusions are:

"I. Congenital dislocation of the hip cannot be successfully reduced after the child is six years old.

"II. That after reduction, the hips should be put in plaster, preferably in the Lange position, *i.e.* (flexion 90 degrees, abduction 90 degrees, inward rotation), flexion to right angle or more, abduction to 90 degrees from the saggital plane of the body, and inward rotation of the thigh with the knee flexed to a right angle. This brings the foot in the right plane for walking when the flexion is reduced at the end of treatment.

"III. Even with unilateral dislocation, both legs should be included in the plaster, which should extend below the knees on both sides—the two legs being placed in similar position. It is best to have the plaster extend from the toes to the waistline.

"IV. The plaster should, if possible, be left on for eight months or more, or, if changed, should only be changed at long intervals. By this method, the growth of the femur in length at the lower femoral epiphysis forces the head of the femur into the acetabulum and compresses the pelvis laterally, thus folding the os innominata in, and deepening the acetabulum.

"V. Perfect functional hips are obtained after reduction of congenital dislocation, but they are not anatomically perfect, as found by x-rays."

That progress has been slow is not surprising since everyone tries to replace every hip that comes to his hand. When Bradford did practically all the hips in Boston, Whitman in New York, and I in Chicago, we each had enough cases to learn something and make some progress. If your Committee that has this subject in hand gains enough evidence to standardize the selection of cases, the manoeuvre to be practised to replace a hip, and the after-treatment, and settles the question as to what cases, if any, should be subjected to a cutting operation, it will be of greater benefit than finding whether the percentage of retained hips is 10 or 80.

In the discussion following the reading of Dr. Adams's paper, I said that in properly selected cases the percentage of retained hips ought

to be 50 for bilateral cases, 50 for anterior dislocations, 75 for superior dislocations, and 100 for posterior dislocations. Several members immediately noted down these figures with questioning glances. Hence this paper.

I have made an earnest endeavor to learn what the results are in the cases with which I have had to do. In my private files I have the names and addresses of 437 cases. I have written to all in which the final result is not already known. Many letters have been returned, marked, "Not found," but I still have a creditable number of cases—about half as many as I thought I had.

For over sixteen years I served on the staff of Wesley Hospital, and it was there that Lorenz did most of his work after he returned from California; but the histories of all patients in the hospital during that time are said to have been burned. I served for a like period at Mercy Hospital, and no records are available there. I served for over ten years at St. Luke's Hospital. The records there are stored in such confusion that they say it takes a day to find the record of one case, so I have made no effort to trace my cases there. I served for twenty years on the staff of the Evanston (Ill.) Hospital. No records are available from there. For over twenty years I did all the congenital hip operations at the Home for Destitute Crippled Children, but the histories are not cross-indexed, and my assistant, Dr. Berkheiser, was able to find only twenty-four with my name on them, among some 12,000 histories that he looked through. Later, the Superintendent found a few more. From the annual reports there appear to have been at least fifty cases. I have operated from Boston to San Francisco, but many of the cases cannot be traced. In June, 1914, I operated on a case at the Massachusetts General Hospital, but after a year Dr. Adams was unable to trace the case, and the final result is not known. The one done at the Children's Hospital for Dr. Bradford cannot be traced. I operated on two cases for Dr. Hibbs at the New York Orthopedic Hospital. In one case I broke the femur. That case is well remembered, and every man from Chicago who has visited the hospital since then has been told of it; the other case was a bilateral one upon which, two months before, Hibbs had done an osteotomy of the femora, with twisting. He replaced the right hip, using his table. I replaced the other without fixation on his table. Both hips were in four years later. I operated on one case for Dr. Townsend at the Hospital for the Ruptured and Crippled; but the case cannot be traced. I operated at Jefferson for Dr. Wilson, but have a record of only one case; and in that the result is not known. I operated at

Rochester, N. Y., for Dr. Prince. The hip is in. At Pittsburgh, I operated for Dr. Silver. The hip slipped out. Dr. Wallace put it in again, and it has remained in. I operated at the Lakeside Hospital in Cleveland, for Dr. Morrill. The child died before the result was known. I operated on several for Dr. Gillette. The result is known in some and in some it is not known. I operated for Dr. Geist before the Central States Orthopedic Club, some time before the war. In 1920, the hip was still in. I operated for Dr. Packard at the Children's Hospital, Denver. The child died before the result was known. I replaced two hips for Dr. Sherman at the Children's Hospital, San Francisco (bilateral case), and Dr. Sherman reported the result as perfect five years later. It is therefore obvious that I am not reporting the final results in all the cases I have operated on.

From June, 1892, to the advent of Lorenz on October 12, 1902, I have record of 55 cases: 6 males and 49 females, with 12 right and 27 left hips, and 16 bilateral—71 hips. Of these 55 cases, I examined but did not treat 38. Some were rejected, some refused operation, and some did not return. In four cases I failed to replace the hips. In two the result is not known. Four unilateral hips are in; and four relapsed; one bilateral case has both hips in, and two have only one hip in, the right in in one case and the left in another—a total of eight hips in and six out. An unknown number of my cases, both failures and those not treated, went to Lorenz.

Of Lorenz's cases I have notes on 16 rejected, 5 failures, result unknown in 3 cases, 2 unilateral hips are in, 16 are out. In one of my bilateral cases with the left hip in and the right out, he replaced the right hip in 1902 and again in 1903, but the patient still limps and it is evident that the "Lorenz leg" is shorter than the "Ridlon leg." A bilateral case that had relapsed from my operation he replaced—both hips. The left hip remained in place but was very stiff; the right hip relapsed. Two other bilateral cases had both hips relapse. In one unilateral case that he thought could be replaced, the operation was done by another surgeon; but in 1921, the father wrote me that the leg is still short. In one unilateral case that Lorenz failed to replace, I immediately replaced, and the hip is still in. In two other cases operated on at his request, I was so unfortunate as to break the femoral necks. He broke the neck in one case and the shaft in another. One case that had relapsed from my operation, relapsed from Lorenz's operation; but in 1904, the father thought had been cured by another surgeon. There was a case that Christian Fenger tried and failed; I tried and failed; and Lorenz tried and failed. There was a boy eight

years old, with a left hip, 1¾ inches short: Lorenz thought it could be replaced. Another surgeon operated when the boy was eleven years old, but the leg is still short.

On October 15, 1905, a Chicago surgeon showed twelve cases before the Chicago Medical Society, all operated on by the Lorenz method. He said that they were all perfect replacements, and that he had knowledge of 32 cases operated on by Lorenz himself, of which 21 were anatomical replacements and 11 sub-spinous. I examined these cases sufficiently to satisfy myself that of the Lorenz cases the five unilateral hips were out, one bilateral case had both hips in, and the other bilateral case had one hip in. Of the five unilateral cases operated on by the surgeon who showed the cases, three were in and two were out. This is mentioned only to illustrate the fact that different surgeons report their cases differently (sic!).

From October 12, 1902, to March 4, 1904, I examined, but did not treat, 22 cases. I failed in six cases. Ten unilateral cases are in; 12 are out. Both hips are in in five bilateral cases, and in three both hips are out. In two cases one hip is in. Of 44 hips replaced, 23 are in and 21 are out. These figures may not agree with those in my paper in the *Journal A. M. A.*, April, 16-24, 1904—they are made from such records as I now have.

During the period between October 12, 1902, and some time in 1905, I operated by the Lorenz method, and during that time I had the mischance to fracture the neck of the femur five times, but I have been able to find the records of only three of these cases. Lorenz broke the neck of the femur twice and the shaft once while I was present. I saw him tear the perineum through from the vagina to the rectum in one case, and paralysis resulted in several. I first abandoned the stretching, and then the use of the wedge-block. The first real advance came with the realization that by fully flexing the thigh and thus throwing the head low, one avoided the greater part of the tension of the adductor muscles and possibly of the Y-ligament as a hindrance and could utilize them as a help to replace the head. Trying to lift the upper end of the femur forwards with my fingers at the back and my thumb in front, I learned to recognize the relation of the head to the socket and could feel the head leave my fingers at the back and rise under my thumb in front just before it slipped into the socket. This was a real advance. Since using this method, now about 17 years, I have broken the neck of the femur only once, and that in a case that had been manipulated by another surgeon for half an hour. I have broken the shaft once—the Hibbs case.

What do I mean by properly selected cases? All cases under two years of age and with shortening of less than one inch, and all cases over five years of age with shortening of over two inches, should be excluded. I have operated on cases of 17, 18, and 19 months, and many about two years of age, with shortening of only ¾ inch, and had many relapses as a result. I have operated on a bilateral case as old as 10 years and unilateral cases as old as 13 years, and on many with shortening of more than two inches—one 3¼ inches—and had accidents and failures and stiff hips as a result. Cases such as these diminish my percentage of perfect results; but I have made no attempt to separate my properly selected cases from the improper ones. I gladly leave that to the Committee. The result of a somewhat more careful selection of cases will appear in the greater percentage of perfect results which is shown by a comparison of my later with my earlier periods, for I have divided the time since March 4, 1904, into approximately five-year periods. A large number of my cases have been cared for by other men; and this always lessens the percentage of perfect results. I operate on a case and it goes home after from three to six days, and I do not see it again until it returns for the removal of the cast. If the hip is securely in place I may never see the child again. If the hip is insecure, I request it to return at the end of six months. If it is then in, I count the case as cured unless I hear from it again. If the hip is out I send the case home to wait until the shortening is a full inch; then to return for replacement. Sometimes they return, and sometimes they do not. If they do not return, they may be satisfied with the result as perfect, or as an improvement from anterior transposition; or they may go to some other orthopedic surgeon. Dr. Francisco and Dr. Wallace each replaced one of my relapsed hips, and got perfect results. Dr. Henderson refused one of my cases, believing it not possible to get a perfect result. Dr. Steindler told one of my cases that the socket was too shallow to hold the hip. I might have differed from Drs. Henderson and Steindler, but I surely appreciate their courtesy to me.

A case is only perfectly followed up when a relapsed dislocation is replaced again and again, and possibly a third time after the shortening has reached an inch or thereabouts. I have not made any earnest attempt to get my cases back and replace them again and again as I ought to have done.

I have found it no easy matter to tabulate 437 cases. I attempted to tabulate ages and amounts of shortening, but gave it up as not of sufficient interest to be worth the trouble. I have not separated an-

terior, superior, and posterior dislocations to determine how many more in one class are perfect than in the others. I have tabulated the number of males and females—57 males and 380 females; the number of unilateral and of bilateral cases. There were 313 unilateral—116 right, 168 left, and 29 not recorded—and 122 bilateral. I have stated whether they were operated on or examined and not operated on by me; of the cases operated on, whether the hips are in, or out, or the result not known; and of bilateral cases, whether both hips are in, or both out, or one in and one out; and which is in and which is out. It is interesting to note that there are more unilateral left hips; and also that in the bilateral cases where one hip remained in and the other slipped out after the first operation the left hip slipped out twice as frequently as the right.

Here follow my results:

From March 4, 1904, to December 31, 1909, I saw 120 cases—13 males and 107 females. There were 91 unilateral—29 right, 52 left, 10 not recorded—and 29 bilateral. Thirty-six were examined and not treated. Of these, one unilateral case spontaneously recovered while awaiting operation (I have had a second case but have no record of it); one unilateral case is reported cured by another surgeon, and one bilateral case had one hip replaced by Whitman by manipulation and the other by the open method. She still limps. In one case I failed to replace. In 12 cases the result is not known. Of the unilateral cases, 32 are in and 22 out; of the bilateral cases, seven have both hips in, five both hips out, and six have one hip in and the other out—52 hips in and 38 out.

From January 1, 1910, to December 31, 1914, I saw 69 cases—9 males and 60 females. There were 52 unilateral cases—21 right, 26 left, and five not recorded—and 17 bilateral. Twenty-six were examined and not treated. One case I failed to replace. In four, the result is not known. Of the unilateral cases, 20 are in and seven are out; of the bilateral cases, four have both hips in, one both out, and six have one in and one out—34 hips in and 15 out.

From January 1, 1915, to December 31, 1919, I saw 63 cases—nine males and 54 females. There were 38 unilateral cases—16 right, 19 left, and three not recorded—and 25 bilateral cases. Ten were examined and not treated. In two cases I failed to replace. In seven the result is not known. Of the unilateral cases, 22 stayed in and seven slipped out; of the bilateral cases, 11 had both hips remain in, and in three both slipped out; in one case, one hip remained in and the other out—45 hips in and 14 out.

Since January 1, 1920, I have delayed operating on four cases until they are older. I have replaced ten. Nine are in and one is out and waiting for more shortening before being replaced.

The Hoffa operation: The one case done by McArthur and me resulted in failure. One case of Bradford's that I examined was a failure. In none of Whitman's open cases that I examined in 1900 was there any useful motion. The two cases operated on in Chicago by Hoffa himself relapsed within six months after the removal of the plaster casts.

The Sherman operation, aimed to slit the narrowed capsule and open the capsular pocket of the socket is, in my opinion, unnecessary if the child is made to walk on the replaced and retained hip for at least six months. Further, I believe it weakens the soft parts supporting the replaced hip. In the bilateral case that I replaced for Sherman, he cut down on the right hip just to see what I had done. When he removed the cast at the end of two months, this hip slipped out, the other did not. Both were finally retained after the child had walked on them for several months, and they were still in at the end of five years.

Osteotomy of the shaft before (Hibbs), or after (Sherman), replacement of the head in the socket appears to me to be absurd; because the operation is based on the assumption that the neck is twisted, carrying the head to the front, and that it needs to be turned back into the socket. The facts are that there are more posterior than anterior dislocations (and the posterior ones ought to turn the head backwards), but most dislocations are directly upwards, and there is no reason for assuming that there is a twist of the neck either to the front or the back.

In going over the histories of my cases, many interesting things are found that cannot be made to appear in a tabulated report.

In 1909 I operated on a boy 3½ years old,—bilateral dislocation. A surgeon at Portland, Ore., removed the cast at the end of eight months; found one hip in and the other out; replaced the relapsed hip without protecting the other hip in the cast. The final result is both hips out. Compare this with a girl operated on by Henderson and Meyerding. Their result was one hip in and the other out. Somewhat later, when the shortening amounted to nearly an inch, I replaced the relapsed hip, protecting the good hip with a cast to the knee. Both hips are now in.

In 1900 I operated on a girl four years old,—bilateral. The result was the left hip in and the right relapsed. In 1902 Lorenz said that

the left hip was perfect. He replaced the right hip, but did not protect the left. The Lorenz hip slipped out, and he again replaced it in 1903. The result as shown by x-ray pictures taken about two years later, showed my hip turned forwards (*i.e.*, the head) and displaced upwards, while the Lorenz hip showed no evidence of a head, but it had a spur of neck pointing towards the socket. She walks with a "dip down" on the Lorenz side. What happened? Perhaps the following case will explain it: When Mr. Bartlett was in Chicago with his machine, a young woman, 26 years old, a patient of Dr. John L. Porter, with a dislocated hip, insisted upon an attempt to replace it. Whether the dislocation was congenital or spontaneous, we could not guess from her story, but Dr. B. E. McKenzie of Toronto had treated her with a long traction hip splint. At the operation, Bartlett worked the traction mechanism and Porter the lever to pry the head into the socket. When they were unable to replace the hip and the region back of the femoral neck had been badly bruised, Porter asked me to try to replace it by manipulation. With the exercise of little force, the neck of the femur broke. During the following six or eight weeks the broken-off head was so completely absorbed that it did not show in the x-ray plate. Before the operation, it had appeared normally dense.

The recognition of defective hips that are not dislocated is important. In 1902, Lorenz replaced the left hip, two inches short, in a girl of ten years. When I removed the cast eight months later, the hip operated on was in anterior transposition, while the other hip was dislocated upwards and backwards. In 1903, Steele (D. A. K.) and Porter replaced the right hip of a girl after having an x-ray picture which showed the left hip in the socket. When the cast was removed, the hip operated on was in place and the other hip was out. I examined the case in May, 1904.

Operations on very young children should not be done; practically all of mine have relapsed. Compare the following two cases: In 1904 I operated on a girl 19 months old. Six years later, there was a shortening of an inch. In 1912, I was requested to operate on a girl 16 months old. I refused to operate until she was older. After a delay of two years I replaced the hip. Now, seven years later, the mother writes, "The hip is perfectly all right." Another reason for not operating on very young children is that I have had two babies brought to me with dislocated hips, in which the femoral heads could be felt under the buttock muscles when the thighs were flexed and adducted, and they appeared less well in the sockets than the opposite hips by the x-ray

pictures, but when the children were brought for operation at the proper age the hips were found not dislocated.

In 1904 I attempted to replace a hip only one-half inch short, in a girl of 17 months. I did not know why I failed until some years later, when operating at the Home for Destitute Crippled Children, before the members of this Association, on a very young child with little shortening, I thought I was going to fail, but on reducing the amount of flexion of the thigh, thus raising the head in relation to the socket from a too low position, it readily entered.

By the same token it is not well to attempt to replace hips in very old cases. In 1914, I examined a girl 17 years old, whose hip another surgeon had attempted to replace six months before. The hip was still out and the leg paralyzed. The result of Lorenz's work in Chicago left some cases of paralysis, but in so far as I know, all recovered. One of these cases was recently examined for me by Dr. Eikenbary. Lorenz failed to replace the hip; told the father that he had really put the hip in; collected $500; when the cast was removed again, told the father that the hip was in. The same day I examined the child and had an x-ray plate made. The hip was out. The girl recovered from her paralysis and is now very well satisfied with the result.

In 1914 I operated on the right hip of a girl 9 $^{7}/_{12}$ years old, at the request of Dr. Loman. The shortening was 3¼ inches. The replacement was very difficult. The child suffered very much for ten days. After the cast was removed, at the end of eight months, the hip slipped out. Two months later I replaced it. A year later it was out again, and the x-ray showed a small and flattened head.

In 1902 Lorenz refused to operated on a girl of nine years with the the left hip dislocated, but advised me to do so. I did,—and broke the neck of the femur. The leg was put up in a cast in moderate abduction. A year later there was still some abduction, and quite a stiff hip, but she walked very well.

Lorenz failed to replace the hip of a girl seven years old, which I immediately replaced. On removal of the cast, at the end of eight months, the hip was in and the femur of normal shape, as shown by the x-ray picture. Twelve years later, she came in to show me her perfect hip. I found a leg ¾ inch short, and the x-ray showed that the head had been displaced downwards—coxa vara—to the extent of the shortening. In those cases that have replied to my letters of inquiry saying, "The girl walks well, with scarcely a limp, but has ½ to ¾ inch shortening," I wonder whether such hips have coxa vara, or are out. I have tabulated them as out.

How should a case be tabulated that was operated on by Lorenz when nine years old, right hip, two inches short, which on removal of the cast I found to be one inch short, but the mother now says is a perfect hip? I have tabulated it as out.

Lorenz failed on a girl nine years old, left hip, 1¾ inch short, after both Christian Fenger and I had failed. But after 19 years, I examined the woman and found her walking with scarcely a limp—wearing an extended shoe.

In 1903 I operated on the left hip of a girl 18 months old for Dr. Gillette. In 1914 he wrote: "I find 1¾ inch shortening. Greater trochanter above Nélaton's line. Motion free in every direction. Resembles a coxa vara." I wonder what the condition really is; but I have tabulated the case as out. In the same way, I have tabulated the result in the right hip of a girl of seven years. Hip replaced in 1917. On removal of the cast, Dr. C. A. Parker thought the head anterior. The father now writes: "Some shortage exists. Amount not known. Big girl. No discomfort or fatigue."

It is a good rule to never attempt to replace a hip that another has tried and failed to replace. In 1908, Dr. J. B. Murphy asked me to operate on a girl, bilateral, seven years old, with 2¼ inches shortening. The right hip was no more difficult than would be expected in a girl of seven years with a 2¼ inches shortening. When I attempted the left hip, I found the feel quite different, and on turning the child over, found a bruise from the wedge-block back of the neck of the femur. Nevertheless I was seriously assured that no attempt had been made to replace the hip. The result was that the right hip is in and the left anterior.

Some five years ago I was assisting Dr. C. A. Parker. After a prolonged and futile effort he asked me to try. The femoral neck broke in my hands with less than half of the usual force used to replace a hip. Did I break it, or did we both break it? This is the only fracture of the neck that I have had since I abandoned the Lorenz method. I have broken the shaft of the femur once (Hibb's case—a girl with bilateral dislocation, seven years old, 2½ inches shortening, that never should have been attempted). By the Lorenz method I broke the neck of the femur five times, but I find only three among my tabulated cases. In 1902, I saw Lorenz break the neck twice and the shaft once. The difficulties presented by some cases may be illustrated by the case of Dr. M. L. Harris, reported by me in 1905 (*Chicago Medical Recorder*, September, 1905). A girl, five years old, bilateral. Harris, assisted by Ryerson and Hosmer, attempted to replace by the Lorenz method.

and failed. Three days later, the same three surgeons, with Mr. Bartlett and his machine, tried, and failed. Nine weeks later, Harris replaced the left hip by the open method. Four months later the cast was removed and the head of the femur found dislocated on the dorsum of the ilium. Harris, assisted by Ryerson, attempted a "bloodless" reduction, and broke the femur in the neighborhood of the trochanters.

In 1905, I examined a girl from Boston who had had a bilateral dislocation. Bradford had replaced one hip by manipulation. When it relapsed he did the open operation. That also relapsed, and the hip was still out. The other hip was replaced by the Bartlett machine, and remained in.

In 1907, I examined a girl 7½ years old with 1¼ inch shortening. The mother stated that when the child was 14 months old, Dr. A. H. Ferguson operated. Without attempting to replace the head in the socket, he had turned down a flange from the outer table of the ilium over the head. The x-ray picture showed it apparently as after the operation. The mother said that the shortening had not increased.

Other congenital malformations sometimes add to the interest of these cases. My first one was a girl four years old whom Lorenz refused to treat. In addition to both hips dislocated forwards, she had recurvated and stiff knees, talipes equinovarus, clubbed hands, somewhat flexed and stiff elbows, and webbed axillae and little movement at the shoulders. The hips were replaced, the knees and feet cured, and the hands greatly improved. The next case was a girl of three years. She had the same deformities of the lower extremities. The third case, a boy, 2½ years old, had dislocated hips, straight, stiff knees with absent patellae, equinovarus, clubbed hands, shoulders somewhat stiff, prepuce adherent, and meatus urinarius opening back of the glans penis. I did not treat him. Another case, of which I have no record, had the left hip dislocated, recurvated left knee, and equinovarus of the left foot. All were cured. Another, a girl four years old, had the left hip dislocated, the limb ¾ inch short and bilateral genu recurvatum. A girl, born with spinal kyphosis and talipes calcaneus, had a hip spontaneously dislocate when 3½ years old. Another girl, in addition to dislocated hips, had spina bifida (lumbar), recurvated knees, equinovarus, paralysis of motion and sensation in the feet, incontinence of bladder and bowel, and hydrocephalus. Otherwise she was normal. These cases of multiple deformities have usually walked very little or not at all, and the replacement of the dislocated hips, which are usually forwards, is very easy

All such hips that I have replaced and caused to be used in walking for at least eight months have remained in. I have had one congenital dislocation in a child with spastic paralysis. I tenotomized the adductors before replacing the hip.

As to preliminary stretching before replacing difficult hips: My last case was in 1903, a girl nine years old, bilateral, three inches short. After six weeks weight-and-pulley traction, the hips were easily replaced. But it was found that this cut off the pulsation in the posterior tibial arteries. The cast was removed and the hips re-dislocated. Two cases not included in my 437 were not dislocations at all. Both were publicly operated upon by Lorenz as congenital dislocations and so reported in the newspapers. One was a girl of eleven years, operated on in San Francisco. The father brought to me, two years later, copies of the papers in which the full details of the operation were published, even to a fake x-ray picture. The case had been treated some years earlier by Dr. H. M. Sherman for hip tuberculosis. She never had a dislocation. The other was a girl of three years that I had treated for a year for active tuberculosis of the hip. Lorenz manipulated the hip, which had no deformity, at Mercy Hospital before a large audience, as a case of congenital dislocation, and the daily papers so reported it; but he put on a cast, not with the thigh in right-angled abduction, but straight down, and privately asked me to remove the cast at the end of a month and continue the treatment.

The tabulation of some cases has been difficult. One case that I examined in 1906 was operated on by another some months later. The hip is now out and the leg short. I have tabulated it as a hip that is out, not as one examined and not treated. In 1914, I replaced the left hip in a child of three years. The hip was in on removal of the cast. Now, 1921, the mother writes: "She gets around fine, but the hip is not filled out well, and there is shortness." How should it be classified? I have counted it as out.

On several of my relapsed early cases Lorenz operated; all were failures or relapsed, and I have counted them only once, as my failures and relapses. For the main thing that we wish to know is: What per cent. stay in—not who put them in, or who failed to keep them in.

Finally, let me say that some of the 1915-19 cases that are now out will be put in again. Some will stay in.

I have missed a number of operations by refusing to operate on very young children with shortening of only ½ to ¾ inch. I have attempted several cases that were too old or that had too much shortening, with the result of some fractures and some stiff hips. Some of the

cases rejected twenty years ago write me that their hips trouble them very little. Some of the cases where Lorenz tore the adductors and, failing to replace, put the leg in plaster in abduction for several months, believe that they are greatly improved. Lorenz spoke of "perfect" results and "good" results. The good results were those cases in which the head passed forward from the socket and then went up to 1 to 1½ inch and became anchored near the anterior superior spine of the ilium. The lordosis of the spine and flexion of the thigh were wiped out, and the patient stood straight and walked well. These are certainly good results when one cannot get perfection.

In none of my cases is there any evidence that a hip that remained in for a year after the removal of the cast has ever relapsed unless subjected to traumatism sufficient to dislocate a hip with a large and shallow socket.

In none of my cases is there any evidence of a narrowed or contracted socket. In every relapsed hip that has been radiographed in adult life, the socket has been shown to be large and shallow. Radiograms of the sockets of young children do not show the real shape of the sockets. Doubtless there are sockets too shallow to retain the relapsed heads, but most of the ultimate failures should be credited to operating too early, to lack of use during the period of retention, and neglect to replace the hip a second or third time after allowing sufficient time for shortening to take place.

From my records it is not possible to answer all of the details asked for by your Committee:

1. The age is generally on my records.

2. Also, which hip, or both. Those having other congenital defects are recorded. None had rickets.

3. X-ray pictures, both before and after the operation, are available in comparatively few of the cases.

4. My cases are classified as to the method of reduction. Since 1900, all cases have been put in plaster casts in right-angled abduction with 90 degrees outward rotation, except such as felt more secure without rotation, and these latter which require the plaster below the flexed knee have been released to the knee at the end of two months to enable the children to walk. This allows the thigh to rotate out to about a mid-position. All cases have been held in plaster casts in right-angled abduction for eight months or more.

5. The plaster cast—a heavy one—has been put on over stockinette covered with half an inch of sheet wadding bandages firmly and smoothly bound down by a roller bandage. In unilateral cases, only

one leg has been included. In a single relapsed hip in bilateral cases both hips have been put in the cast. All cases walk as soon as possible; unilateral cases within two weeks, and bilateral cases within two months. After the removal of the cast the parents flex, adduct and rotate inward the thighs.

6. I class my cases as "in" when they are in, and as "out" when they are out; but hips that are out may be "good" hips. They should be so classified if they have good abduction and no more than 1½ inch shortening when fully grown. Many with two inches shortening think that they have good hips. All others are failures or relapses. Some failures have useful limbs if given full abduction. Some perfect replacements have a "poor" result because of stiffness due to too extensive shortening of the muscles at the time of operation.

7. None of my cases have been goniometered.

DISCUSSION ON PAPER OF DR. RIDLON AND REPORT OF THE CONGENITAL HIP COMMISSION.

DR. OSGOOD: The discussion on the paper of Dr. Ridlon and the Report of the Commission will be opened by Dr. E. H. Bradford of Boston.

DR. E. H. BRADFORD, Boston: *Mr. President:* I think that the Committee are to be congratulated, not only on the boldness of their undertaking, but also on the thoroughness of the attempt. I feel that they have shown to us how difficult the task is.

It is undesirable to take up the time of the Association with any remarks, especially as I am to be accorded, on Monday, the privilege of presenting this subject later. It is most gratifying that this subject be brought up and thoroughly discussed. When first presented to the American Orthopedic Association, many years ago, it was looked upon as a discussion of an impossibility. The treatment of congenital dislocation of the hip was formerly considered almost useless. The only question at present is as to the best method of operation and in how few cases failure may be expected.

Dr. Bradford stated formerly that he was of the opinion that the reduction by open incision was the most reliable method of treatment in these cases and he has performed over fifty cases by open incision, with a fair percentage of satisfactory results, but later experience has convinced him that the manipulative method, properly performed, with careful after-treatment, gives the best results. He stated that he is confirmed in this opinion by an examination of several cases, ten, fifteen and twenty years after reduction, some by open incision and others by manipulative method. Functional results in the latter were superior to the results obtained by reduction by open incision. The results now obtained give evidence that the deformity, properly treated, is an eminently curable one.

DR. HENRY LING TAYLOR, New York City: *Mr. Chairman and Gentlemen:* I have a few words to say. This demonstration is of extraordinary interest

and value. The members of the Commission have shown that this is a very complex subject—much more so than we realized before—and that this renders the classification of the cases and of the results exceedingly difficult. We shall await the final report with a great deal of interest. I have just jotted down a few notes in which you may be interested. I indicated in a paper, two or three years ago, that the conditions in babies were very different from those in older children, much more favorable, and they should be operated on at once. My suggestion was that babies had a much deeper acetabulum; that, when the deformity was reduced, the reduction took care of itself, and that these cases could easily be reduced without giving an anesthetic. I, myself, have tried this, at the Hospital for Ruptured and Crippled, in the last two years, and I have found it to be true that cases in infants can be reduced without an anesthetic and without too much pain. However, we have not found the acetabulum much better than in the later cases, or that the cases in infants retained themselves. They had to be put up in plaster, and the cases followed the course of older cases. In the case of an older child with a displacement of only three-fourths of an inch, even after anesthesia, we found it very difficult to reduce it by that technique. We gave up the Lorenz technique, bit by bit, from the start, making it milder and less violent, until there was nothing left of it. Then, when we became more familiar with the French technique, we adopted it, with good results. I learned that from Dr. Ducroquet, who visited this country some years ago. It consists in reducing the hip and stretching it afterwards—in about seventy per cent. of abduction, with inward rotation from the start, if practicable and if the reduction holds, and increasing inward rotation as the abduction and flexion are reduced. My results since adopting this technique have been extraordinarily better.

I believe, also, as has been suggested, that the after-treatment is important, and a feature of the after-treatment that I emphasize is the reduction of the inward rotation, which I do by adhesive plaster strapping. The child is encouraged to pronate for some time after all the plaster is removed. This is a great advantage.

I appreciate the anatomical points brought out, and, as Dr. Bradford stated, the fact that the x-ray, unless it is good and you know how to read it, is a fallacious guide.

Another thing that I want to mention is the formation of new bone in the hip. I have observed that new bone was formed in the acetabulum by deposit at the superior edge of the acetabulum.

DR. ALBERT H. FREIBERG, Cincinnati: I shall not detain you more than a moment. As one of the earlier advocates of these commissions, I wish to express my approval of what the Committee has done and to say that I am convinced by what it has done that this is a good way to investigate subjects of interest to us. I feel, however, that a suggestion to the Committee would not be inopportune.

I think that, perhaps, the members of this Committee are making the scope of their investigation too broad. This makes the investigation more difficult. In making a report, no one speaks of his failures, but only of those cases that he believes were successful, which have stood the test of three years. I, too, have had failures—plenty of them. I believe that in the future work of the Committee, the scope of the investigation should be limited. In that way, we shall have results more valuable and easier to use. The question of the abnormality of the supposedly normal hips is interesting because, twenty-two years ago, I reported that in forty per cent. of the cases there was some abnormality found in the supposedly normal hip.

DR. WALTER G. STERN, Cleveland, O.: I was very much surprised to learn from the report of Dr. Adams, that no one but myself had used the Worndorf-Schlesinger position. When I visited the Lorenz Clinic in 1899 and 1900, I was impressed with the terrific force used to reduce the hips, and in the work that I was allowed to do there, I did not use the brutal method that

they employed. I succeeded in getting the hips back. When the Commission came, they did not use the force that Lorenz used. There are some other positions besides the Frog-Schlesinger-Worndorf. The Schlesinger was used where one had not succeeded in reducing the hip, to put it up in plaster; and in a few weeks it was possible to succeed, in some cases, at the second sitting, in reducing the hip. Worndorf suggested that in cases in which you got the hip in place but in which it immediately dislocated when the hand was taken off the knee, you put it up in such an exaggerated position that the knee come under the chin and then leave the cast on for many months.

My 199 cases were not typical Lorenz operations. They were done by a manipulative method. It is a hark back to older methods. I do not claim credit for it myself. Last June, I had my assistant collect all the cases over three years old and report on them. His report is found in my report.

Dr. John Ridlon, Chicago: Many years ago I read a paper on "Spontaneous Dislocation of the Hip," and called attention to the fact that the condition might be called that, instead of "congenital dislocation." I brought out the fact that many defective hips are not congenital. I showed a picture of an elderly man who had never had trouble, and only three-fourths of the head of the femur was included in the acetabulum. The question of continuous pressure from growth as mentioned by Dr. Adams, I have not tried. Of course, it is a choice whether you will try to get the head to go in by that method, and not lose all the benefit of walking, or whether you will use the benefit of walking and discard that method. I believe that the benefit from walking in the plaster cast, after one month in unilateral, and after two months in bilateral cases, is more and more to be recommended. A large percentage of these cases we have no final reports on. Those in which we know whether it was in or out, we only know whether it was in when last seen. Some that were in then may have come out since. The Committee should remember that the proportion of these would be the same as in those which we do now.

As to the standard neck, shown in the pictures, and dwelt on so strongly by the Committee, I think that it is all nonsense. If you notice, the neck is as big as the shaft. The neck, normally, is not so big as the shaft. It has been discussed in what position the hip should be placed in order to best retain it. I think that the best position is the one that is found by the manipulator to be the most secure, when he has replaced the hip. That is all there is to it.

Dr. Joel E. Goldthwait, Boston: I have nothing to say in conclusion, except that the Committee will welcome criticism or suggestions from you, and will work accordingly, as far as we are able. We are your servants. Let us know what you want us to do, and we will go at it.

We felt that the broad attack was necessary first, and then we could draw our conclusions in regard to special things afterwards. We supposed that you wanted the entire subject covered. We, as a scientific body, ought to be able to speak of every phase of it with reasonable intelligence.

MANIPULATION OF STIFF JOINTS.

BY SIR ROBERT JONES, LIVERPOOL, ENGLAND.

One of the difficult problems presented to a surgeon is the decision as to when a stiff joint is to be moved and when it is to be rested. In other words, the diagnosis between a joint rendered stiff from active, even if very mild, arthritis, and a joint hampered in its movements by adhesions or adaptive muscle shortening.

An arthritic joint is dependent upon rest as a preliminary to motion. A joint restricted in its movements by extra-articular adhesions has to be approached with the view of movement active and passive. If adhesions do not yield readily to active and gentle passive efforts, the question of more forcible methods has to be considered. Attempts at moving arthritic joints lead to greater stiffness in consequence of inflammatory reaction. It is necessary, therefore, to emphasize certain principles to assist us in making a differential diagnosis.

A painful joint which is rigid in all directions is the seat of an arthritis, while a painful joint which is rigid in certain directions only —movements being normal in others—is free from arthritis. This is more obvious in joints such as the wrist, shoulder, hip and spine, which have a comprehensive range of movement, than in joints such as the elbow, ankle and knee, where the movements are practically limited to flexion and extension.

If there be no limitation of movement in a suspected joint, there is no arthritis. In early cases the rigidity must be examined for without an anaesthetic, as it is primarily due to protective muscular fixation. Later, contractures or muscle shortening will follow as secondary effects, but by then a diagnosis will be obvious. One illustration will suffice to make this clear. A girl complains of pain in the dorsolumbar region of her spine. The surgeon asks her to flex, extend, rotate and laterally move her spine. If she can do so she has neither adhesions nor arthritis. Another may have great tenderness over her spine, and is unable to fully flex or laterally deviate her spine, but she can hyperextend. This case can be assumed free from arthritis and may probably have adhesions. A third case is rigid in every direction, and her condition may be diagnosed as an arthritis.

This classification requires modification when we deal with fractures into joints with bony blocks, or with myositis ossificans in the muscles surrounding a joint.

Adhesions may be divided into two groups—(a) intra-articular; (b) extra-articular.

Intra-articular adhesions may be the result of rupture of joint capsule, of hemorrhage, or of the plication, with adhesion, of the synovial membrane. Rupture of the intra-articular ligaments, such as the crucial and ligamentum teres, do not give rise to adhesions which require surgical attention.

Extra-articular adhesions may be connected with the capsule, the ligaments, muscular origins or insertions, rupture of the muscular fibres or blood extravasation into tendon sheaths. Stiffness of the joint may also be the result of adaptive muscular shortening, physiological in character, or it may be due to loss of resilience in the sheaths surrounding muscle and muscle fibre.

Prolonged immobility of a healthy joint will result in temporary stiffness, which is usually due to adaptive shortening of soft structures, and this can be rectified without forcible manipulation.

The stiffness of the knee following a simple fracture of the shaft of the femur is usually overcome in three or four weeks if the fracture is not in the neighborhood of the joint. If the fracture has been compound and septic the stiffening is often most intractable and may give the surgeon much anxiety, but our war experience has taught us various methods by which joints may be kept mobile while the fracture heals.

THE PREVENTION OF ADHESIONS

Adhesions are avoided by early and safe resort to active and passive movements. These movements should be practically painless, and should consist mainly in assisting the patient to move his own joint. If there has been no direct injury to the joint the proposition is a simple one, but care is needed that the movements practised on the joint are not conducted to the fractured shaft, while means should be adopted which will permit uninterrupted extension. It is here that the training and ingenuity of the orthopaedic surgeon counts.

In direct injuries to joints unaccompanied by fracture, movement may be given immediately on the cessation of acute symptoms. The joint should be immobilised until the acute symptoms have passed. The clinical test of the cessation of acute symptoms is the disappearance of swelling and tension pain. When local effusion and tenderness abate, the patient may be allowed to commence gentle active movements. He will surely be careful to move the joint gently enough to avoid pain and danger. *In the case of children*, gentle passive movements may be started before active movements, and they should be

so conducted that the joint is ultimately moved in each direction that its anatomy permits. The full range of movement should not be attempted at once, nor should there be practised more than one movement in each direction. It should be designed to gently free the way for movements in order to prevent the formation of adhesions. It is necessary that the child's confidence and good will should be assured. You cannot give of your best to a child who fears you. A surgeon who deals with a child should gain its trust and love.

ON BREAKING DOWN OF ADHESIONS

Light adhesions may be broken down under gas, or gas and oxygen: if strong and resistant, full anaesthesia is best. Complete muscular relaxation is rarely obtained under gas, and, in consequence, the surgeon is less able to gauge the force he should apply. The joints should be moved through the full anatomical range unless the adhesions are extremely firm. If firm and resisting, the movements should be less complete, and full mobility should be secured in stages. The advantage of the use of gas is that the movements may be voluntarily practised almost at once, and this is of considerable psychological advantage. After all adhesions have been overcome, and while the patient is asleep, the limb should be placed in the position of full correction until he recovers consciousness and is able to make a voluntary effort. This helps to emphasize the right of way, and furthermore, has a good mental effect, for the patient, when he becomes conscious, realises that the obstruction has been overcome. The earlier movements are practised after manipulation the better, for the pain is less acute and the results more rapid and effective. If, however, the manipulation has been very severe and reaction is feared, it is advisable to fix the limb for a few days in the corrected position in order to rest the assaulted joint, massage being substituted for movement.

The normal range of movements in a joint varies in different people and at various ages. It is advisable, therefore, during our manipulation of any joint, to compare its range of movement with that of the opposite side. Unless this is done, it is easy to produce a sprain.

If, as a result of manipulation, the range of movement is diminished, it is fair to conclude that the after-treatment has been defective, or that the manipulation has been ill-advised. After the joint has been conducted through its complete range of movement once, it is useless and often harmful to repeat the procedure. The "pump handle" method, as applied to the breaking of adhesions, or the practice of

passive movements, is to be avoided. Voluntary efforts, however, can be repeated with advantage as often as the patient can be persuaded to make them.

Passive movements and the breaking of adhesions by manipulation in the presence of fracture near a joint, should be most carefully performed. The fracture should be adequately protected from strain by closely applied splints.

If effusion should take place in a joint after manipulation, it is strongly suggestive of the rupture of intra-articular adhesions. Such effusion does not necessarily imply that the manipulation should not have been employed *unless* the effusion is accompanied or followed by a diminished range of movement. If the range of movement is diminished by use and exercise, the joint requires rest. If, even in the presence of pain, the range of movement is increased by exercise, rest is contra-indicated.

The rupture of typical adhesions is heard and may be felt under the hand. If no click is heard or felt, but the resistance is overcome by a gradual stretching, the prognosis is not so good, and the joint should be retained at rest for a few days in its new and corrected position. Passive movements should then be gently practised. Pain which is sharp and of short duration is negligible, but if pain continues for protracted periods, it means a reaction likely to be followed by increased stiffness, and calls for rest.

FORCIBLE MANIPULATION AS APPLIED TO INDIVIDUAL JOINTS.

Shoulder.

The dangers to avert in forcible manipulation of the shoulder are fracture and dislocation. Normally the humerus can be abducted almost to a right angle from the body without scapular aid. It can be rotated a little more than a third of a circle. The internal condyle on complete external rotation of the arm, points a little to the front of the side. The arms can be abducted by scapular aid in a young adult so that they lie parallel above the head.

The patient should lie on his back while an assistant places his fist in the axilla to protect the head of the humerus from displacement or fracture. The surgeon should then grasp the arm above the elbow with one hand and abduct it; with the other, he should control the shoulder girdle to fix the scapula. When the right angle is reached, the scapula is left free, and the arms should be abducted to the normal range of movement. A comparison with the movements of the second arm will check the surgeon from over action. When the arm is fully

abducted, the patient's hand should be placed behind his head, and the joint should be pressed backwards until the arm assumes the position it occupies during a yawn. The shoulder should then be rotated inwards and the forearm placed behind the back. The forearm should then be brought to the front and fully extended and supinated to free any adhesions which may have formed about the biceps tendon. The shoulder is then circumducted, the palm of the hand being finally placed behind the occiput. The patient should awaken from his anaesthesia in this position. The rotations must be very carefully performed in order to avoid fracture, and abduction is also a movement which may produce fracture in the aged. In addition to stiffness following sprains of the shoulder or adhesions in connection with bursae. we may have to break down adhesions in fracture of the anatomical or surgical neck of the humerus, in reduced dislocation of the shoulder, in fracture of the outer end of the clavicle, and in separation of the tuberosities; and on recovery from the subacute arthritis which follows a fall on the shoulder or a fall on the palm of the outstretched hand.

In fracture of the neck of the humerus, great care should be taken to avoid refracture. and forcible movements should never be attempted in less than two months after injury. I have known the arm to be refractured on many occasions. In fracture of the greater tuberosity, special attention should be concentrated on the rotary movements.

The condition which I have called subacute arthritis of the shoulder requires a short description. It is usually due to a stubbing of the joint, and is often associated with a Colles' fracture. Old people with a Colles' fracture often complain of pain in the shoulder about three or four weeks after their accident. The symptoms are rigidity in all directions; pain on pressure over the front of the joint just to the outside of the coracoid, and inability to lie upon the shoulder. The signs of recovery are a shifting of pain from the front of the joint to the insertion of the deltoid and ease when lying upon the shoulder.

Elbow.

The management of the elbow joint requires more care and judgment than the shoulder. If the adhesions are light and there is no injury to the joint, all that is needed is to completely flex and extend with the forearm first in complete pronation, then again in complete supination. In this way adhesions of the radio-ulnar articulation are simultaneously overcome. If adhesions are firm and limitation of movement marked, as is often the case in the presence of an old frac-

ture, the elbow should be gently extended in supination and then flexed to safety point, and fixed in this flexed position by a sling for a few days. It should next be extended and fixed in extension for no longer than two days. When freed, active and gentle passive movements may be practised. While these passive movements are performed the fracture should be protected from strain by splints. The movements may require repeating in a few days.

The stiff elbow joint, especially in the case of children, often becomes mobile by use, even in those cases where passive movements are followed by reaction; and it frequently happens that when massage and passive movements have failed to make an impression, and have been discontinued, the child will appear a few months later with free motion in the joint.

When, in the course of passive movements, an elbow-joint becomes more stiff, and that painlessly, traumatic myositis ossificans should be remembered as a possible factor. This condition is generally associated with fracture or dislocation, and it will often be found that the coronoid process is torn away.

The manipulation of the elbow joint should always be gentle, and if the range of movement increases by use, even if very slowly, voluntary exercise should take the place of passive movements. If motion becomes restricted with exercise, rest is called for.

The Wrist.

This joint should be dorsiflexed, palmar flexed and moved laterally. These movements should be followed by circumduction. The fibro cartilage and carpus should be moved to and fro on the head of the ulna while the forearm is supinated. If these movements are restored without much force, active movements should be allowed immediately. If dorsiflexion has been difficult, the hand can be fixed in this position for a day or two. If palmar flexion is limited and cannot be corrected without considerable force, the hand should be fixed in the corrected position for twenty-four hours in order to avoid reaction, and then active movements can be practised.

Adhesions of the mid- and postcarpal joints are met with, chiefly in connection with Colles' fracture, or with fracture or dislocation of the carpal bones—most frequently the scaphoid and semilunar. Free movements must be secured quite soon when these fractures have occurred, as later massage and manipulation will not secure free mobility at the wrist. Immediate correction and temporary fixation, either in dorsiflexion or palmar flexion, is therefore imperative.

The disabilities following fracture with displacement of the scaphoid and semilunar are often very obstinate. If in the case of a recent injury to these bones after attempted reduction movement is free, a perfect result can be predicted. If, in spite of such attempt, movements are restricted, the bone should be removed, as no subsequent treatment will restore ball motion. If the scaphoid or semilunar is removed at once, a good result may be expected. If the removal be postponed, the function of the wrist will be imperfect. If an operation be refused, the dorsiflexed position of the wrist should be secured.

The movements between forearm and carpus are condyloid, and therefore all movements, excepting rotation, are possible. The movements of the mid-carpal joint are those of flexion and extension, with very slight rotation and a slight gliding movement. These should be remembered when manipulation is performed.

In manipulating the fingers, extension should always be employed while adducting and abducting. Rotation should be practised while the fingers are slightly bent. The movements should be gentle in order to prevent tearing of the ligaments. All manipulations of the fingers should be practised with the wrist dorsiflexed.

The Hip.

In addition to the stiffness of the hip joint as sequelae of so-called sprains, I would like to call attention to the marked pain and stiffness which are associated with hypertrophic osteoarthritis of the hip of the mon-articular type, and the relief which is so often derived from manipulation under an anaesthetic. If the osteophytic excrescences are not excessive, and the subject not too frail and old, I very frequently attack the adhesions so inseparable from the condition. The results are often very dramatic. The pain almost disappears, and the range of movement is very materially increased. The improvement lasts for two or three years, sometimes more. In such cases, the full range of motion is never attempted, attention being specially directed to external rotation and to abduction. Forced movements of an intensive type are begun the next day, and cases which I would have looked upon in former days as destined to lead the life of a chronic painful invalid may, by this expedient, have their outlook considerably brightened.

In manipulating the hip joint, the patient lies on his back with both limbs fully extended; they are then rotated inwards and outwards. The legs are next crossed in adduction, to be followed by flexion of the knees to right angles and the thighs abducted. Full

flexion at the hips should be followed by abduction, rotation and circumduction. These movements are best performed simultaneously on both sides so that the limits of normal movements may be noted. For complete extension, the patient lies on his back with the pelvis supported at the end of the table, and the limb is extended, while the good thigh is flexed on the abdomen. In circumducting the hip, the foot should be conducted through a series of circles of increasing circumference.

The Knee.

The knee very frequently calls for manipulation. It is a joint very apt to deceive a surgeon, owing to the apparent simplicity of its movements. In a ball and socket joint, the variety of movements which are displayed allows a wider scope for differential diagnosis. It is so often the seat of mild septic infections and effusions of a chronic type, accompanied by pain, which tend to make a surgeon overcautious. In certain disabilities, it is found slightly flexed, which is also fairly constant in arthritis. In addition to this, a knee may present a glazed appearance accompanied by exquisite tenderness, both to touch and movement, so that any drastic interference with it seems hazardous. I will describe three types.

A middle-aged woman appears with a knee in full extension. She is unable to bend it beyond a few degrees, and any attempted movement gives rise to great pain referred to the front of the knee. There is no effusion; she walks comfortably in a splint, which she has worn at intervals for over twelve months. Careful inspection reveals a swelling about the lower part of the ligamentum patellae, with a slight oedema on pressure. Massage and attempted passive movements have, on each trial, had to be abandoned because of pain. She has many x-rays, which show no abnormality. The oedema and acute pain have been generally diagnosed as periostitis of the tibia. This proved to be a case of adhesions about the insertion of the ligamentum patellae, brought about by prolonged kneeling. Rapid manipulation of the knee resulted in complete recovery in less than three days.

A young man met with an accident at football four months previously. The knee was displaced and was reduced, so he said, the same day. Effusion followed the strain, and for a fortnight he wore a splint. He was a joiner, and went to work, his knee feeling a little stiff, and mild effusions recurring. On examination, he had slight pain on pressure in front of the internal lateral ligament, and when any effort was made to hyperextend his knee, he complained of con-

siderable pain at that spot. When he tried to extend both knees and a comparison was made, it was noticed that his injured knee fell just short of complete extension. This condition, commonly met with, was recognized as an incompletely reduced semilunar cartilage. Manipulation and immediate exercise restored the function of the joint.

A youth twists his knee and sustains injury to the internal lateral ligament. Three months later all his movements are free, but he complains of pain on walking, especially if he traverses rough or undulating ground. For this reason he is unable to play games. There is slight pain on pressure over the ligament. If the knee is flexed to 90% and rotated, pain is at once referred to the same place. This was a case where adhesions had formed between the internal lateral ligament or capsule, and the internal meniscus or coronary ligaments. Manipulation rectified the condition at once. The point to note in regard to manipulation for this somewhat common condition, is that while the knee is flexed the head of the tibia should be rotated inwards and outwards on the femur. This is the particular movement that counts. The symptoms are frequently mistaken for recurring partial displacement of the semilunar, and provide a rich harvest for the irregular practitioner.

These three types are worth recording as they are so generally overlooked, even by observant surgeons.

Should the old displacement of the semilunar, with its symptom of very slight flexion at the knee, cause the surgeon to fear arthritis, he has only to remember that in arthritis the knee becomes more flexed with use, while in the case of the cartilage the angle tends, if it alters at all, to diminish as time passes. The arthritic knee is warmer than normal: the knee which requires manipulation is usually cooler.

Before manipulating a knee, the patella should always be examined. It is never safe to attempt to bend a knee with fixed patella; nor is it wise to attempt forcible manipulation in cases where the quadriceps is firmly adherent to the femur. Intra-articular adhesion following mild septic infections can be cautiously forced. It is safer, however, to adopt the more gradual methods which I have discussed elsewhere in dealing with such cases.

In breaking down adhesions, the joint should be fully flexed while the tibia is rotated upon the femur. This rotation should be continued while the limb is brought into full extension.

In displacement of the cartilage, the joint is first fully flexed and, while in this position, the leg is rotated inwards. If no anaesthetic is given, the patient is asked to kick his leg as if at a ball, while pressure is applied simultaneously downwards above the knee and upwards below the ankle.

If full easy extension is not at once secured, the displacement is not corrected. The same manipulation is performed if the patient is under an anaesthetic, the internal rotation being maintained until extension is complete. In reducing displacements or breaking down simple adhesions, the finger should be firmly pressed upon the painful spot. The adhesions can usually be felt to give below the finger.

If the adhesions are firm the patient should be laid on his face with the front of the thigh resting on the table—both hands can then be used to flex and rotate the joint.

In dealing with the adhesions which follow fracture of the lower part of the femur, the thigh must be well protected by splints and the flexion should be recovered by steady pressure.

The Foot.

There are so many conditions of the foot benefited by forced movement that I will content myself by mentioning only one. It is a type of foot always treated by the methods we apply to the falling arch. It is associated with the adolescent and the middle-aged, and although the feet are flat, the symptoms are due to other causes.

In concentrating upon deformity as orthopaedic surgeons, we are apt to pay unreasonable homage to the obvious. If a person complains of the foot, we are only too ready to rush to the conclusion that the inturned ankle or flattened arch is the Alpha and Omega. It matters little whether the good foot is more deformed and without pain, or that the site of pain is anything but classic. Metal arches, crooked heels and cheery optimism, however, have their limitations. How rarely do we find a perfectly formed foot, and how often we find perfect function with faulty alignment. This should teach us to be humble and observant. I will describe two clinical types which, perhaps, you have already observed.

A middle-aged woman complains that her foot has broken down. She tells us she has always had flat foot. She never remembers hurting it, but admits that during the war she has had to stand a great deal. Her trouble has lasted twelve months, and she has undergone most types of treatment. Plates give her some relief, but the pain is sometimes very severe. She has pain over the dorsum of the foot and along the plantar fascia—sometimes under the deltoid ligament. She is fretful and irritable. The foot is painful on manipulation, especially over the upper part of the dorsum or when it is twisted. It has been labelled "static flat foot," and "rheumatic" flat foot. She never remembers having rheumatism.

We break down adhesions under an anaesthetic,—systematically attacking every articulation. We hear and feel them give. Massage, exercise and normal boots, in a few days, complete her cure.

A young man eight months previously was trodden upon by a horse. No fracture of any of the bones could be found. He had not been able to play any games since. His foot was flat and painful, especially over the scaphoid and cuneiform. There was a swelling over the dorsum which varied from time to time. The case was diagnosed as adhesions on the dorsal aspect of the mid-tarsal joint, and it reacted at once to treatment.

The more I have realized the fact that adhesions are often the source of pain in certain types of flat foot, or foot strain, the more interesting and even dramatic the sequences of events. There is the greatest difference between a calculated rupture of adhesions and the practise of passive movements. In one case the foot is irritated; in the other, it is released from bondage.

I may, perhaps, be excused for bringing before so expert an assembly a subject such as I have chosen, but I do think more attention should be given in our literature to a branch of work very much ignored and very little understood. It seems strange that I, an apostle of rest and immobility, should preach a sermon upon the advantages of movement. The doctrine that an inflamed joint requires rest is beyond discussion, but we should endeavor to draw a distinction between the real and the apparent, and not allow caution and timidity to obscure our critical faculties.

FRACTURES OF THE ELBOW IN CHILDREN.

BY JAMES S. STONE, M.D., F.A.C.S., BOSTON.

In this paper consideration is confined wholly to fractures of the lower end of the humerus. Fractures of the head of the radius, of the olecranon process, or of the coronoid process, or avulsion of the surface of the coronoid by action of the brachialis anticus are merely mentioned.

So far as routine treatment can be laid down, what should be done with the usual transverse supra-condylar fracture? Reduction under full anaesthesia, either before there has been great infiltration of blood through the soft parts or after this has begun to subside. In no case without sufficient reason should there be delay of over a week or ten days. In two weeks reduction by manipulation has become more difficult as a result of beginning organization in the tissues. Reduction should be attempted with the elbow fully extended, if necessary slightly hyperextended. With the upper arm held firmly by an assistant, strong traction is applied to the supinated forearm. It is usually necessary in addition to fully extending the forearm to rock the fragment into place by moving the wrist first to the radial and then to the ulnar side. More especially is it necessary to rock to the radial side to bring the inner side of the fragment into position. While traction is still maintained the elbow is to be fully flexed. If this can be done without hindrance and if there is no tendency to displacement when the forearm is lowered to a right angle, reduction is generally satisfactory.

The elbow is then held flexed midway between pronation and supination by strapping wrist to shoulder with adhesive plaster and adding the support of a sling. One strip of adhesive should lie inside the arm and wrist. The second should be outside. It is of the utmost importance that two pieces be used rather than one and that, especially about the arm, both lie smoothly so that the upper edges are under no greater tension than the lower. A triangular sling the long side of which is passed between the elbow and the body and the points of which are then brought round the neck in a figure of 8 is perfectly satisfactory. The angle at the elbow may be pinned up. In this way the joint is left wholly accessible to inspection and to care against maceration of the skin in the flexed surfaces which must be kept apart by a layer of gauze.

The flexed position should be maintained for two weeks. Then a change to a right angle splint for at least three weeks and for a sufficiently longer period if necessary to do away with all reflex spasm. Then a sling for a week as a safeguard against accident, and then natural use in play. This is the routine. Within six or eight weeks, motion will be fully restored unless possibly in the last few degrees in the extremes of flexion and extension.

Passive motion is either useless or harmful. We are considering fractures in children. In the joint of a child, there is not only the synovial cartilage but there are the large masses of epiphyseal

cartilage which tend to prevent rough jagged ends of bone from traumatizing the delicate synovial membrane. Fibrous intra-synovial adhesions, though frequent in fractures in adults, are practically unknown in children. There is therefore no need of passive motion to break up joint adhesions.

The two causes of limitation of motion after elbow fracture in children are first, spasm, and second, deformity. Spasm indicates one thing, that motion would cause pain. It is nature's demand for rest, and rest must be given till spasm is gone. Time and again, fractures in which the splints have been omitted before the spasm has gone, come in with an extremely restricted range of motion. Two weeks of absolute rest in splint and sling will show double or treble the range of motion immediately on removal of the splint as compared with what existed when the splint was applied. Spasm means that the callus is not firm. Every movement irritates the callus; microscopic capillary hemorrhages occur. There is an increased tendency to proliferative new bone formation. The callus instead of solidifying and shrinking becomes larger and not firm. I have seen cases in which continued forced passive movement under an anaesthetic led in time to complete bony ankylosis with absorption of the synovial cartilage. Passive motion under such conditions is absolutely harmful and inexcusable. Reflex involuntary spasm always demands rest. The restriction of motion by spasm is comparable to the limitation in the motion of a door owing to rusty hinges. Continued pressure causes continued yielding. There is no clean cut limit to the range of motion.

Deformity is the other cause of limited motion. The limitation is clean cut, definite, comparable to the stopping of a door by an obstruction. Primarily of course the deformity is bony, in part the result of imperfect reposition of the fragments, in part of callus formation. But secondarily, there may be all sorts of ligamentous and muscular readjustments which limit motion.

In overcoming deformity the decrease in the size of the callus, the gradual absorption of bony projections, and growth, and adaptive changes are the essential factors. Undoubtedly passive motion helps to attain all these objects, but if gentle, passive motion does no more than the child does constantly in active play. If the passive motion is more violent it may possibly do a little good, but at the expense of a tender arm which the child will refuse to use naturally for several hours. Passive motion is either harmful or useless in elbow fractures in children.

In cases of deformity, even of marked degree, it is amazing how rapidly an excellent functional result is attained. It is, however, common in fractures involving the internal condyle to observe a loss of the carrying angle even when full flexion and extension are possible.

In very rare cases, there persists a marked loss in the range of motion, but even in these cases, time is a great factor for recovery if one can only be patient enough. Repeated tracings of the range of motion, taken at three or four-month intervals, usually show steady progress. If progress finally ceases, the question of operative interference arises. As a rule any attempt to increase motion by trimming off projecting edges of bone is a disappointment. Only one factor among many is removed. Two other courses are open, one by supracondylar osteotomy to transfer a given arc of motion from a less useful to a more useful range. The other is an arthroplasty or a resection. As a rule none of these procedures should be undertaken while the factor of growth is still to be considered.

In a certain number of cases attempts at reduction by manipulation fail. Attempts may be repeated, but not oftener than once or twice, and especially must repeated attempts at reduction be avoided after the fracture is two or three weeks old. By that time new bone has begun to proliferate from detached periosteum, and the greatest care is necessary to avoid the spread of this new bone among the soft parts.

If perfect reduction is possible, then the choice must be definitely made between open reduction and letting alone. The question resolves itself largely into whether better reduction can be secured by incision than is already attained, and if better, how much better functional results will be attained. In general, the more skilled a surgeon becomes in the manipulation of fractures, the fewer cases of elbow fracture in children will he wish to open. If operation is undertaken only absorbable sutures should be used, and preferably they should involve only periosteum and fascia. In maintaining apposition the flexed position should be the main reliance. An anterior incision is for this reason undesirable. When the elbow is flexed the chance to dress the wound is poor. Maceration of the skin with the possibility of infection will occur.

One group of cases requires open reduction, those in which the epiphysis of the external condyle has been detached and has turned turtle. The slightly concave fractured surface points upward, outward, and backward. The articular surface lies in contact with the fracture line at the lower end of the shaft. Replacement by manipulation is usually impossible. The fragment has been locked beyond

a dead center. Through an external incision exposing the fragment it may readily be pried into place with a blunt dissector. There will be no difficulty in retention. A suture of the fascia and the flexed position insure a secure retention.

The operation may be done immediately before there has been great infiltration of the tissues, or later, after the swelling has begun to subside. If, for any reason, reduction has been unduly delayed, it is possible up to about six weeks after the injury to curette away the new soft callus which has grown out from the raw surfaces and restore the fragment to its normal position. Later on, however, the fragment becomes altered in shape, and the space from which it was torn fills in with new bone. Under these conditions removal of the rounded fragment which is in the way and usually attached by fibrous tissue to the shaft is the best treatment.

Very rarely, a somewhat analagous fracture of the inner condyle occurs. The same principles of treatment apply if reduction by manipulation cannot be accomplished.

I wish to add a few words regarding the recognition of epiphyseal separations, especially those in which the epiphysis is loosened but not displaced. In these cases, the x-ray may often be wholly negative. The diagnosis must be made by the history, the disturbed function, and the local tenderness. Owing also to the slight subperiosteal hæmorrhage the supra-condylar ridge is apt to show a loss of clean cut sharp outline. Such cases must be immobilized at right angles but need not be kept at rest for so long a time as is necessary in the case of a complete fracture.

Volkmann's ischaemic contracture is one of the most serious and distressing complications of elbow fractures. It is, moreover, one which is difficult to excuse Any muscle deprived of its blood supply, whether by shutting off of the arterial supply, or by stopping of the venous return, or by pressure of bandages for a period of about six hours or less, undergoes a degenerative change from the complicated muscle cells to low grade scar tissue. Contraction of the scar causes flexion of the muscles. The muscle cells not actually destroyed are caught in a mass of contracting scar tissue. The anterior muscles of the forearm are peculiarly liable to this distressing condition. In addition to the involvement of the muscles the scar tissue may by pressure impair the median and ulnar nerves, thus affecting the strength of the intrinsic muscle of the hand.

Within a year I have reduced a fractured elbow, placed it in acute flexion and found an immediate cessation of the radial pulse and a

blanching of the forearm and hand. Immediate incision and exposure of the line of fracture failed to show just how the artery was pinched.

Obstruction to venous return through traumatic thrombosis may cause tremendous congestion of the muscles of the forearm. For the relief of this condition, J. B. Murphy advocated incision of the sheath of the muscles. Personally, I have never seen a case requiring this.

Too tight bandages or bandages becoming too tight after swelling has occurred is the common story. Anticipation of this possibility and the warning to slash all restricting bandages at once will obviate many a condition which otherwise will be crippling to the patient and an everlasting plague to the surgeon. In the face of threatened blood supply to the muscles of the forearm, the position of the fragment is of very minor importance. Blood supply can never wait; position can wait.

The treatment of the condition is not within the scope of this paper. The prevention alone is considered, and to the surgeon setting the fracture, it is enough.

ARTHRODESIS OF THE SACROILIAC JOINT. A NEW METHOD OF APPROACH

BY M. N. SMITH-PETERSEN, M.D., BOSTON, MASS.

Up to the present time, operative work on the sacroiliac joint has been decidedly unsatisfactory. The reason is quite plain; the joint is very deeply located in a region which excludes any approach from anterior and superior aspects. This leaves only two possible avenues of approach; the posterior and the lateral. The different methods of approach from the posterior aspect all offer great difficulties, and only in the case of Dr. Painter's[1] approach is an actual exposure of the joint accomplished. Dr. Painter's approach, which consists in turning back a flap of bone from the posterior portion of the ilium, is too extensive to undertake except as a last resort.

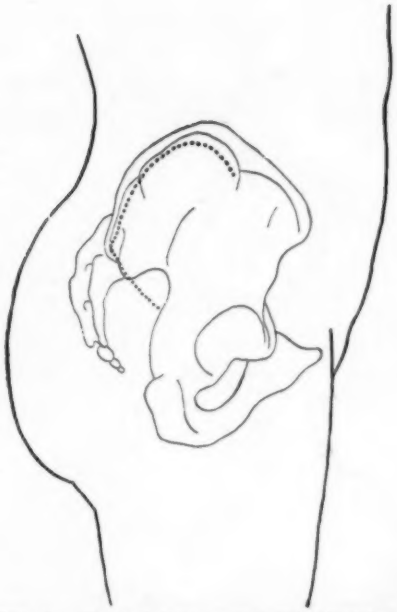

FIG. 1.—Dotted line represents incision in its relation to the ilium; curved limb of the incision extends from the posterior superior spine two-thirds of the distance to the anterior superior spine. Straight limb from the posterior superior spine in the direction of the fibers of the gluteus maximus muscles for a distance of approximately three to four inches.

FIG. 2.—Flap reflected by subperiosteal dissection from lateral surface of the ilium. Dotted line shows sacro-iliac joint projected on the lateral surface of the ilium with windows cut in two different planes.

How about the lateral approach to the joint? What chance of exposure does this allow? In the literature on the sacroiliac joint, no article or reference to this route has been encountered, and yet it seems the most logical approach. This method has been used in a number of cases during the past three years, and the experience of the operator has been the same in every case: an anatomically easy approach with no trauma to important structures, resulting in good exposure of the cartilagenous joint surfaces of the ilium and the sacrum. The principle of the operation is similar to that described for the hip joint,[2]—a sub-periosteal approach.

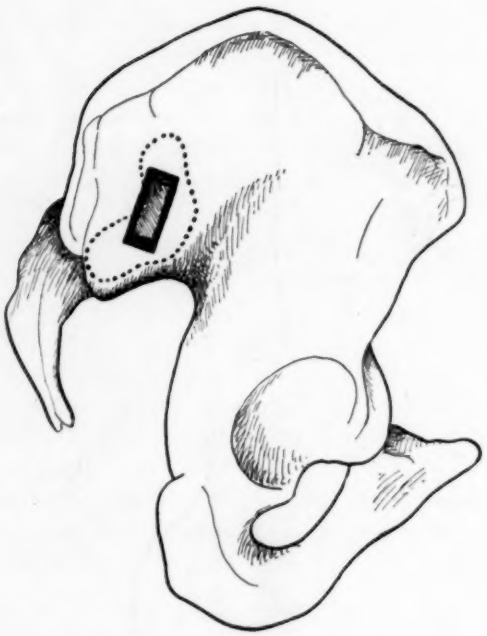

FIG. 3.—Dotted line represents sacroiliac joint projected on the lateral surface of the ilium. Window removed as described for cases of tuberculosis or of relaxation of the sacroiliac joint. Note that the window is well posterior to the median gluteal line and just above the sacro-sciatic notch.

The steps of the operation are as follows:

1. Curved incision from the posterior superior spine along the crest of the ilium, two thirds of the distance to the anterior superior spine. This incision is carried down to the bone and the reflection of the periosteum started. (Fig. 1.)

2. Incision from the posterior superior spine in the direction of the fibers of the gluteus maximus for a distance of three to four inches. (Fig. 1.) This incision is carried down through the subcutaneous fat and gluteal fascia and the muscle fibers of the gluteous maximus separated by blunt dissection, until the junction of the ilium and sacrum, between the posterior superior and posterior inferior spines is reached. In carrying out the dissection, one point should be kept in mind: the superior gluteal nerve and artery emerge at the anterior portion of the sacro-sciatic notch and give off posterior branches which are en-

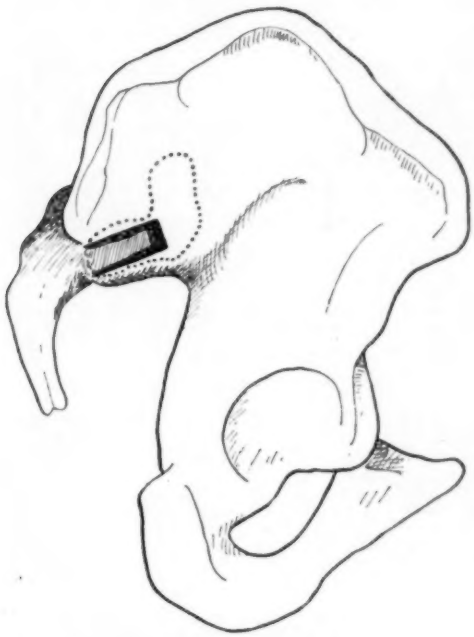

FIG. 4.—Dotted line represents sacroiliac joint projected on the lateral surface of the ilium. Window removed as described for cases of osteomyelitis: from posterior border of the sacroiliac joint between posterior superior and posterior inferior spines. It runs anteriorly parallel with the sacro-sciatic notch.

countered by the straight limb of the incision, and sometimes cause considerable bleeding. They have to be sacrificed in order to get a satisfactory reflection.

3. The flap thus outlined is reflected sub-periosteally, exposing the posterior portion of the lateral surface of the ilium. (Fig. 2.)

4. If the sacroiliac joint is projected on the lateral surface of the ilium, it will be found that the inferior border corresponds with the sacro-sciatic notch, and the anterior border with the median gluteal line. (Fig. 3.) The superior border is not of importance, because the two above landmarks determine the location of the joint sufficiently. A window is now cut through the ilium within the projected area of the joint. (Fig. 3 and 4.) A window, rectangular in shape, has been used in the majority of cases. (Fig. 3 and 4.) The thickness of the ilium just above the sacro-sciatic notch is considerable, sometimes as much

FIG. 5. (*a*)—Cross section of sacroiliac joint and of the posterior sacroiliac ligament.

FIG. 5 (*b*).—Window removed from ilium down to joint surface.

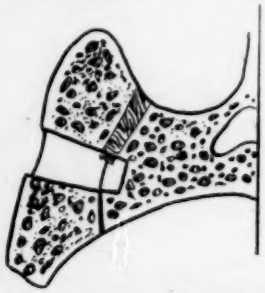

FIG. 5 (*c*).—Cartilage removed from joint surface of the sacrum as well as underlying cortex, exposing cancellous bone.

FIG. 5 (*d*).—Window replaced. It bridges the joint and cancellous bone is in contact with cancellous bone.

as an inch, but if care is taken, the entire block of bone from the outer to the inner table of the ilium may be removed in one piece. The operator is rewarded for his labor when, upon removal of the window, the cartilaginous joint surface of the sacrum comes into view. (Fig. 5B.) The cartilage of the sacrum as well as its cortex is next removed, bringing about a good exposure of cancellous bone. The above procedure results in a rectangular channel bordered on all sides by cancellous bone, extending from the ilium through the sacroiliac joint into the sacrum. (Fig. 5C.)

5. After removing the cartilage and cortex from the block of bone removed from the ilium, this is replaced in its original site and countersunk, so that its cancellous surface will be in contact with the cancellous bone of the sacrum. (Fig. 5D.)

6. The flap is now returned to its place and periosteum and soft parts sutured in layers.

The position of the window should be varied according to the case

encountered. In purulent infections of the joint, the window is cut in a direction parallel to the sacro-sciatic notch; this will give efficient drainage of the joint. (Fig. 4.) In cases of tuberculosis, it is better to cut the window at an angle as a better dowel is thus obtained. (Fig. 3.) This, of course, also holds true in cases of sacroiliac relaxation.

In cases of tuberculosis, the above description and diagrams do not hold absolutely true, as the curette has to be used extensively to reach the parts of the joint not actually exposed. Seven cases of tuberculosis of the sacroiliac joint have had arthrodesis of the above type during the past three years, with uniformly gratifying results. Cases of relaxation of the sacroiliac joint which have had the above type of arthrodesis performed, have also been uniformly successful. They are, however, only six in number, three of them too recent to judge.

REFERENCES.

[1] Boston Medical and Surgical Journal, Aug. 13, 1908, page 207.
[2] Am. Journ. Orth. Surgery, August, 1917.

THE APPLICATION OF MUSCLE PHYSIOLOGY TO THE TREATMENT OF PARALYSIS.

BY LENNOX G. TEECE, M.D., CH.M., SYDNEY, AUSTRALIA.

WITH the gradual evolution of tendon transplantation from the position of an experimental surgical procedure to that of a soundly established method of coping with irreparable paralyses, greater attention has been focused on the physiological problems involved in the operation. In its earliest days, the mechanical aspect monopolized the attention of surgeons to the exclusion of other considerations, with the result that many operations were performed that we now realize to have been surgically unsound. The pioneer operation of Lange of transplantation of the peronei into the tendo Achillis for the relief of paralytic calcaneus, particularly instanced the neglect of the first mechanical consideration, in that in this operation the transplanted muscles were much weaker than those whose function they attempted to assume. This obvious mechanical deficiency of plan quickly attracted attention, so that we soon found Codivilla and others compil-

ing tables giving the relative power of the muscles of the extremities and drawing attention to the necessity of selecting sufficiently strong muscles for the purpose of transplantation. As time went on, the physiological aspect received increasing notice; the desirability was emphasized of selecting the muscles to be transplanted from the same synergic group as the paralyzed ones and greater attention was paid to the after-treatment and to the education of the transplanted muscles, though this latter point will never receive its due meed in those centres where this operation is in the hands of surgeons unequipped with proper orthopaedic training.

Finally, in recent years, the most notable advance has been due to the work of Mayer and Biesalski, as well as to that of Steindler. The former's discovery of the importance of the preservation of the gliding mechanism of the tendon and the latter's researches into the nutrition and vitality of the transplanted tendon have further served to direct our notice to the supreme importance of devoting minute consideration to all the physiological aspects, when planning any operation of tendon transplantation. The purpose of this article is to emphasize one such aspect that, in the opinion of the writer, has not received its due share of consideration. In order to secure the most fruitful results, it is necessary that the surgeon should be possessed of a complete knowledge of the different properties of muscle function; he must know and take into his reckoning not only their action as prime movers, but also their synergists and antagonists, and the occasions on which they act as fixation agents. Our present purpose is to examine the practical application of the recent advances in our knowledge of muscle physiology to the needs of the orthopaedic surgeon.

As a result of the war, we have delved into a storehouse of infinite clinical material, the results of the battle casualties, and in it we have found a hitherto unequalled collection of peripheral nerve injuries, injuries so varied in type that we have encountered sharply localized paralyses of every individual nerve trunk, and even of the branches to individual muscles and groups of muscles. Thus we have been enabled to enlarge our knowledge of the individual action of most of the muscles of the extremities, and to apply our knowledge to the elucidation of the problems, not merely of peripheral nerve injuries, but also of infantile paralysis, of which the victims are always with us, be it peace or be it war.

The fundamental essentials of the treatment of every type of paralysis may be grouped as follows:

1. A thorough understanding of the function and action of the individual muscles.

2. An accurate determination of the muscles that are paralyzed and their possibilities of spontaneous recovery.

3. The methods of encouraging the recovery of voluntary power, such as reëducation, massage, and electricity.

4. If the paralyzed muscles are incapable of recovery, can their functions be assumed spontaneously by other muscles, or can other muscles be trained to take upon themselves the responsibility of the lost function? In default thereof, will surgical intervention, by altering the function of certain muscles, suffice to restore in part at least the deficient movements?

Consider first the functions and actions of individual muscles. This subject is far more complex than it appears at first sight. Primarily, let us state that each muscle possesses two opposite functions, contraction and relaxation, and as emphasized by Colin Mackenzie in his book, "The Action of Muscles," these two functions can only be exercised at different times. Relaxation is as much an active process as contraction and is just as much the result of a nervous impulse. When down the path of the motor nerve there travels an impulse to a muscle to contract, there simultaneously travels to its antagonist an impulse to relax, and *pari passu,* these two active physiological events occur. This is the explanation of the smooth, even nature of human muscle movements as opposed to the jerky movements of an automaton. Illustrative of the necessity of this active physiological relaxation is the condition of hyperextension of the knee-joint, which sometimes develops in cases of quadriceps paralysis. This is the result of the patient actively producing complete relaxation of the hamstrings at the moment that he commences to swing the leg forward. It swings forward with considerable impetus as it is unchecked and uncontrolled by the normal gradual relaxation of the hamstrings that should occur. Thus it swings till the knee locks in full extension and the repeated jar at length leads to stretching of the posterior ligament of the joint and hyperextension of the knee. Thus the physiological purpose of active muscle relaxation is to act as a brake on muscle movements and to protect the ligaments of joints from overstrain. The inability of a muscle to be simultaneously in a state both of contraction and relaxation may be visually exemplified by studying the action of the dorsal interossei muscles of the hand. The action of these muscles is to extend the two terminal phalanges of the fingers. If the finger be held firmly flexed at the first interphalangeal joint, so that consequently the dorsal interosseous mus-

cle is relaxed, then any active voluntary extension of the terminal phalanx becomes impossible. The muscle being actively relaxed to allow of the flexion at the first interphalangeal joint cannot at the same time pass into a state of active contraction to extend the terminal phalanx. Though the physiological contraction of a muscle is normally accompanied by the physiological relaxation of its opponents, under certain conditions of functional disease this may not be so. In some cases of functional paralysis, the disability is due to the fact that an attempt to contract one group of muscles evokes not a relaxation, but a simultaneous contraction of its antagonists, with the result that no movement takes place in either direction. Furthermore, we must distinguish between relaxation and elongation. Here again we may quote Mackenzie: "Elongation of muscle is not a physiological action, but is produced as a result of a mechanical action; relaxation is essential for elongation and must precede it, but there is no inherent force in a relaxed fibre that produces elongation." For example, in the case of a paralytic wrist drop, the extensors are relaxed, even though the wrist be supported on a cock-up splint; remove the splint, and the force of gravity immediately elongates the paralyzed muscles, which are now both relaxed and elongated. Relaxation is never harmful; prolonged elongation invariably is.

Next let us consider together postural length, postural tone and muscle elasticity. Normal muscle possesses a considerable amount of elasticity, by virtue of which it adapts itself to movements of joints over which it passes but on which it does not act. Let us examine the extensor communis digitorum in this light; this muscle passes over but does not act on the wrist joint. Strongly extend both wrist and fingers; while still holding the fingers extended, flex the wrist. Then the extensor communis digitorum, though it has remained in strong contraction all the time, has had its total length, from origin to insertion, increased by this second movement, and its adaptability to this alteration in the distance from origin to insertion without lessening its contraction, is due to its elasticity. Thus elasticity is quite distinct from contractility.

Every muscle has its normal postural tone and postural length, the latter dependent on the former and both subject to alteration in disease. The postural length of any muscle is the length that muscle assumes when both it and its antagonist are in a state neither of active contraction nor of active relaxation; that is, are in equilibrium. The postural length is chiefly dependent on that peculiar inherent quality of muscle known as tone; it is tone that gives that distinctive resilience to touch

to a normal muscle as compared with the flabbiness of paralyzed muscle. It is due to tone that when a muscle contracts it at once commences to produce the movement for which it is designed, so that there is no time lost in taking up slack before the contraction becomes effective. Also affecting postural length is the condition of the other constituents of muscle apart from muscle fibers, namely, the muscle sheath and intermuscular connective tissue; it sometimes happens as a result of prolonged overstretching that a muscle, while still retaining its power of contractility under voluntary control assumes a new postural length greater than its normal, and it then conversely occurs that at the same time its opponents acquire a new postural length less than the normal. This frequently happens in cases of wrist drop that have recovered in spite of neglect of adequate splinting; in such cases there may be—provided we can neglect ligamentous opposition to movement—full muscular contractility and a range of movement, as measured in degrees, equal to normal, but movement from a position of hyperflexion to one of less than full extension. Thus in cases of functional paralysis the last step in the march to recovery is usually the restoration of normal postural length. The subject of a functional wrist drop, who has so far recovered as to perform full movements, will frequently be noticed to carry his wrist in marked flexion when the part is inactive and his attention distracted elsewhere. This is because the altered postural lengths,—lengthened extensors, and shortened flexors,—now have their position of equilibrium a position of flexion of the wrist instead of the normal position of equilibrium which is the mid-position. Loss of tone of a muscle frequently results in the assumption by it of a postural length greater than normal, and loss of tone in greater or lesser degree is an invariable accompaniment of muscle injuries. This includes the unavoidable muscle injury inflicted during the performance of a tendon transplantation and is a strong argument for the necessity of gentle handling. We have all noticed how, after injuries to the muscle substance of the flexors of the fingers, for some time finger flexion remains incomplete, even after the commencement of this movement has become powerful. The delayed restoration of the last few degrees of this movement is due to the injury causing loss of tone, which has resulted in an increased postural length of the muscles so that when contraction is complete for the new postural length, the origin and insertion of the muscles are farther apart than they should normally be and the fingers are therefore not completely flexed.

Having considered the vital endowments of muscles in general, let

us now pass on to deal with their functions, both individual and interdependent. As Wood Jones has clearly pointed out, these functions are four in number: (1) prime movers; (2) antagonists; (3) synergists; (4) fixation agents.

1. Their Action As Prime Movers.

This, the simplest action of muscle, requires no elaboration except on one point. Thus the action of the brachialis as a prime mover is to flex the elbow joint. But we may ask, does each muscle possess one and only one function as a prime mover, or may it perform different movements? Take the example of the biceps brachii, on the subject of whose functions much disputatious ink has been spilt. Is it a flexor of the elbow, or a supinator, or is it both? Mackenzie stoutly maintains that each muscle is a specialist in function, having one and only one duty to perform, and having correspondingly fixed antagonists, which actively relax when, and only when, the first muscle contracts. He would have us believe that the biceps is a supinator only, that its action calls into active relaxation the pronators, that it has no action as a flexor, partly because its action will not call forth a simultaneous relaxation of the triceps, the antagonist of elbow flexion. Mackenzie has done a great service in drawing attention to the science of muscle action, in defining the zero position for muscle reëducation and generally in insisting on the value of this method of treatment which was in danger of being neglected for the more popular massage and electricity. Nevertheless, we must not let his very real achievements blind our eyes to the extent of accepting the evident fallacies as to muscle action, which he has endeavored to endow with axiomatic significance. There is no shadow of doubt that many muscles possess more than one function as prime movers, and we can assert this without denying the principles of antagonism, but modifying Mackenzie's statements by holding that the muscles are provided with a different set of antagonists for their different functions. Let us quote the example of a single muscle, whose action entirely controverts Mackenzie's views. The flexor carpi ulnaris, according to him, is a flexor of the wrist, whose antagonists are the radial extensors and the extensor carpi ulnaris, which must be relaxed when the flexor carpi ulnaris contracts. But perform the movement of ulnar adduction of the hand: by mere palpation of the part, it is evident that this is a movement produced by the combined action of the flexor carpi ulnaris and the extensor carpi ulnaris with simultaneous relaxation of the radial extensors and the flexor carpi radialis. Here, then, we have acting to-

gether two muscles, which Mackenzie declares to be reciprocally antagonistic. Therefore, the separate functions of muscles are associated with separate synergists and separate antagonists. The conclusive explanation and reconciliation of divergent views is as follows: "When a muscle is actively relaxed to such an extent as to allow full action of its antagonists as regards one pair of reciprocal movements, it can not pass into a state of contraction to bring about the other movement of which it is capable and for which it may have different antagonists and synergists, so long as the first antagonists remain in a state of full contraction." Thus the biceps brachii is both a flexor and a supinator, its respective antagonists being the triceps and the pronators; then the biceps cannot flex the elbow when the forearm is held in a position of strong active pronation, nor can it supinate the forearm when the elbow is held fully and actively extended. Again, the flexor carpi ulnaris cannot ulnar adduct the hand when it is held fully extended, nor can it flex the wrist when the hand is held strongly actively abducted. Were the views which have been put forward as to the specialization of muscle function to be accepted, the process of muscle reëducation in cases of recovering paralysis would be greatly simplified. In fact, in some quarters, the acceptance of these views has resulted in misapplied efforts of reëducation and unwarranted optimism as to recovery. In such cases, recovery has been confidently proclaimed in muscles which were still completely paralyzed, the observer being deceived by the assumption of new functions on the part of unaffected muscles, which had taken on themselves the duty of the paralyzed ones. It is, therefore, imperative while reëducating muscles, to be constantly on the watch to be sure that it is they which are contracting and that the movement so obtained is not merely a so-called substitution movement performed by an unaffected muscle. For example, in cases of median and ulnar nerve paralysis, patients frequently learn to flex the wrist by the agency of the extensor ossis metacarpi pollicis.

2. Their Action As Antagonists.

Having dealt with the action of muscles as prime movers, there remains little to be said of their action as antagonists, these two actions being mutually interdependent. The action of muscles as prime movers is entirely under voluntary control; their action as synergists or as fixation agents can, by a process of education, be largely brought within the same category; on the other hand, the relaxation of its antagonists on the contraction of any muscle is not an action of which the

cortex of the human brain has any active knowledge; it is unconscious, automatic and can be neither governed nor regulated by the patient's will. This fact is of great importance in connection with the education of cases in which the operation of tendon transplantation has been performed. The transplanted tendon may be so inserted as to perform a function entirely different to its previous one, that is, we can alter the function of a muscle as a prime mover; then the muscles which were previously its antagonists and relaxed when it contracted, will still do so even though their action is no longer antagonistic to the new function of the transplanted tendon. Sometimes this is of slight importance. For example, when in cases of paralysis of the posterior interosseous nerve the flexors carpi radialis and ulnaris are transplanted into the extensors of the fingers and thumb, their new action of extending the fingers and thumb is accompanied by reciprocal relaxation of the wrist extensors, their former antagonists. Therefore, such cases cannot simultaneously powerfully extend the wrist and digits. Still, in this case, the disadvantage is minimal, for in practice it is found that on extending the digits while the wrist is extended there merely occurs some slight lessening of wrist extension, it does not drop forward into complete flexion. In some cases, however, the relaxation of previous antagonists may considerably mar the success of the operation. Again, to quote the previous example of posterior interosseous paralysis, if the flexor carpi ulnaris be transplanted into the extensor carpi ulnaris, its action as a wrist extensor will be ineffective, because when it contracts to extend the wrist, the radial extensors of the wrist will relax. Therefore, in planning any procedure of muscle or tendon transplantation, due regard must be paid to the question of antagonism.

3. Their Action As Synergists.

The vast majority of the movements of the human frame are the result of several muscles acting in synergism, and it is but seldom that an isolated contraction of a single muscle occurs. Though synergism is the normal action of muscles, it is quite possible, by education and practice, to dissociate the muscle action of the individual members of a synergetic group. A large part of the preoperative and postoperative education of a case of tendon transplantation consists of the educative dissociation of the action of synergists. Thus in a case of localized paralysis of the extensor longus pollicis, we may transplant the flexor carpi radialis into it and we must then train the patient to contract the flexor carpi radialis without a simultaneous contraction of the

flexor carpi ulnaris or else extension of the terminal phalanx of the thumb will be invariably accompanied by wrist flexion. Great as is the desirability of selecting a synergic muscle for transplantation, to replace a paralyzed one, in some quarters undue emphasis has been attached to this point. Of greater importance is it to avoid selecting for transplantation a muscle whose normal action is antagonistic to the new one it is desired for it to assume.

4. Their Action As Fixation Agents.

In the exercise of this function, one or more muscles fix a joint to facilitate the action of some other muscle or muscles. Generally speaking, for strong action of the muscles controlling the movements of the distal joints of a limb, it is essential that the proximal joints should first be fixed by the muscles which control them. For powerful use of the forearm and hand, it is necessary that the subject should have sufficient muscle power and control to fix the shoulder joint. Thus in paralysis of the upper extremity, attention must be focused on securing a reasonably stable shoulder joint. Where this extremity has to be dealt with by two operations, the primary one should be directed to the shoulder. The action of muscles as fixation agents is under voluntary control and transplanted muscles can be taught to acquire new functions in this respect.

The following are the chief points of practical interest to the orthopaedic surgeon in the application of these principles of muscle physiology:

(a) It is desirable that before operation the patient should undergo a short course of muscle training and education. He should be taught the position and action of the muscles concerned, to appreciate the sensation conveyed to the brain by the contraction of muscle, to contrast the characteristic hardening of a contracted muscle with the flabbiness of a relaxed one. He should learn to dissociate the action of individual muscles from that of their synergic fellows. This preliminary enlistment of the patient's coöperation will considerably shorten the postoperative reëducation period and will encourage him to practise the new functions of his transplanted tendons at times apart from those when he is actually undergoing treatment at the hands of the physiotherapeutist. Furthermore, it will eliminate the possibility of the education of trick substitution movements, for he will be guided not merely by seeing the desired movement occur, but also by realizing the sensation of contraction in the proper muscle.

(b) It has long been recognized that any deformity present should

be corrected before transplanting tendons; we can go further and assert that after correction the part should be held in the corrected position for some time before the operation is performed. The unaffected antagonists of the paralyzed muscles will have acquired a postural length less than normal as a result of long continued deformity. Therefore, time must be allowed them to regain their normal postural length, and this is not an immediate process; with appropriate splinting, they are at first merely stretched and elongated; gradually, however, as a result of this stretching, they reassume their old normal postural length. If this precaution be not taken, we measurably increase the early task of the transplanted tendons, for they initiate their new sphere of action under the handicap of being forced to pull against muscles with a shortened postural length.

(c) In selecting muscles for the purpose of transplantation, it is preferable to choose those which normally are synergists of the paralyzed ones. Failing this, choose muscles which, though not synergic, are yet of such situation and strength as to render it probable that they will function satisfactorily in their new position. Above all, avoid transplanting tendons in such a manner that they will be called upon in their new position to work in conjunction with former antagonists.

(d) Avoid transplantations of too complex a nature. In complex operations, success is entirely dependent on the patient's susceptibility to reëducation. In patients of low mentality and in those of the hospital class, it is well to restrict transplantations to those of the simplest type, unless we can be certain of carrying out very prolonged and efficient after-treatment.

(e) Where the paralysis is so extensive as to involve all the segments of a limb and to cause instability of the proximal joints, it is best to fix these joints by arthrodesis before proceeding to transplant for the peripheral portion of the affection. By thus first atoning for the loss of the fixation agency of these joints, we increase the latent possibilities of the transplanted tendons and render their subsequent reëducation much easier, for during this latter process, the patient having a constant fixation of the proximal joints, can concentrate his entire attention on the action of the muscles that are undergoing re-education.

(f) The work of Mayer, Biesalski and Steindler has directed attention to the necessity of careful handling of tendons during operative procedures for the purpose of preserving their gliding mechanism and of preventing damage to their nutrition. Further stress may be laid

on this point on account of the invariable loss of tone that follows any damage inflicted on muscle, and we do not desire to incur the loss of time that would be necessary to wait for recovery of tone before satisfactory reëducation could be obtained. It is not uncommon to find after operation, that the transplanted muscles temporarily lose their response to the faradic current; this is indubitably due to accidental stretching of the motor nerves during the course of the operation, and is a further argument for extreme gentleness. It is difficult enough to reëducate a normal transplanted muscle; we do not desire the added difficulty of dealing with one that is recovering from a paralysis inflicted by the surgeon's carelessness.

(g) Too much stress cannot be laid on the necessity of suturing the transplanted tendon under adequate tension, so that in its new sphere it will commence work with its normal postural length and will not have to laboriously acquire a new one. Indeed, when the common mistake is made of suturing the tendons under insufficient tension, they may altogether fail to acquire the necessary increase in postural length and consequently expend their energy in taking up their own slack instead of producing the intended movement.

In the postoperative treatment of these cases, I would emphasize the usefulness of the Smart-Bristow faradic coil. Full details of the technique of its use will be found in Mr. Bristow's book on joint and muscle injuries. It is invaluable in securing the first contractions in the transplanted muscles and can be regulated to produce contractions of the smallest amplitude. It is of particular assistance for reëducative purposes in giving the patient visual evidence of the new functions of the transplanted muscles.

BIBLIOGRAPHY.

LEO MAYER: Surg., Gynecol., and Obstet., 1916.
STEINDLER: American Journal of Orthopedic Surgery, Vol. xvi, No. 2.
MACKENZIE: The Action of Muscles, H. K. Lewis & Co.
BRISTOW: Treatment of Joint and Muscle Injuries, Oxford Med. Publications.
WOOD JONES: Principles of Anatomy as Seen in the Hand.

Current Orthopaedic Literature

STAVE FRACTURE OF THE FIRST METATARSAL BONE. M. B. Cooperman. *Annals of Surgery*, February, 1921, p. 215.

Cooperman reports a case of stave fracture of the first metatarsal and compares it with the stave fracture of the first metacarpal (Bennett's fracture) which penetrates into the joint with the trapezium, and is due to force acting on the end of the thumb. In stave fracture of the foot the fracture penetrates into the joint with the internal cuneiform, but is due to indirect violence transmitted through the foot from the heel, the metacarpal head being fixed by weight bearing on the ground.—*P. D. Wilson, Boston, Mass.*

DERANGEMENT OF THE SEMILUNAR CARTILAGE; OBSERVATIONS IN 76 OPERATIVE CASES. Louis Strahlmann and J. W. White. *Journal A. M. A.*, Feb. 26, 1921, p. 561.

In this article the authors state the following as their conclusions:

1. The most reliable diagnostic features in this condition are: (*a*) traumatic origin with recurring disability; (*b*) definite localized pain or tenderness; (*c*) "locking"; (*d*) sense of derangement or feeling of insecurity; and (*e*) swelling.

2. We believe that simple hypermobile cartilage is a definite entity requiring surgical treatment, and that it is more common than fracture of the cartilage.

3. As complete excision as possible is the operation of choice, and, with proper aseptic technique, can safely be performed.

4. Once the diagnosis is definitely established, prompt operative interference should be seriously considered, provided, of course, there is sufficient disability.

5. The prognosis should be more or less guarded in cases with long-standing symptoms and when, on operation, the cartilage is found to be lacerated or comminuted.

6. Operative results are better than statistics indicate, untoward results being due to the facts that, first, the deranged cartilage is only a symptom of an unrecognized, and sometimes undeveloped, condition such as a syphilitic or tuberculous joint; second, the original trauma and consequent atrophy cause a permanent injury to other joint structures in addition to the cartilage derangement, which is logically not improved by its excision; and third, too much of the cartilage is left in the joint either as an attached extremity or as fragments.—*Lloyd T. Brown, Boston, Mass.*

RECURRENT DISLOCATION OF THE SHOULDER JOINT; A MECHANICAL CONSIDERATION OF ITS TREATMENT. J. W. Sever. *Journal A. M. A.*, April 2, 1921, p. 925.

The author says that the only portion of the joint capsule of the shoulder joint is that portion between the insertion of the triceps on the lower edge of the glenoid fossa and the subscapularis above. This is the portion of the capsule which is supposed to be most frequently torn in these dislocations

and, as a result of this primary tear, there results a relaxation of this portion of the capsule, which allows subsequent and recurring dislocations, always, however, the result of unbalanced muscular effort. The atrophy of the above mentioned muscles, all of which have a direct action in keeping the head of the humerus in the glenoid cavity, would naturally lead to a loss of this control more or less great, and plus the presence of a weak, stretched or torn capsule, would establish an ideal condition for recurring dislocations.

Combine this with the forward pull of the lower portion of the pectoralis major on the head of the humerus in abduction and elevation, the position in which dislocation occurs, and the result must be another dislocation.

The author advises, therefore, complete division of the pectoralis major without subsequent suture, as well as a definite shortening of the tendon of the subscapularis. Capsulorrhaphy is not an essential feature.

Complete division of the pectoralis major has been done in about 40 cases with no untoward results. The arm can be abducted quite as well as before and no essential loss of function has been observed.—*Lloyd T. Brown, Boston, Mass.*

TYPHOID SPINE. Barclay Moffatt. *Jour. A. M. A.*, March 5, 1921, p. 639.

Report of a case of typhoid spine at the annual clinical conference of the Hospital for Ruptured and Crippled. The author quotes Murphy and others, but makes no mention of Rogers' article. He has nothing new to offer.

He comments that the interesting points seem to be: (1) the occurrence of lumbar pains; (2) the formation of a kyphosis, though the roentgenograms were negative; (3) the ease of reduction of deformity. This was done by plaster casts.—*Lloyd T. Brown, Boston, Mass.*

DISLOCATIONS OF THE SEMILUNAR CARPAL BONE. Isadore Cohn. *Annals of Surgery*, May, 1921.

A presentation of one case which was treated by excision of the semilunar bone. The author reviews the anatomy of the dislocation, but presents nothing new. He states that in an extensive experience of ten years at the Touro Infirmary in New Orleans he has seen one case.—*P. D. Wilson, Boston, Mass.*

BONE GRAFTING: STUDY OF CASES OPERATED UPON IN U. S. ARMY HOSPITALS. J. B. Walker. *Annals of Surgery*, January, 1921.

This is a short article based on figures in the Surgeon-General's office and is inconclusive because of the incompleteness of the figures.

Records show that among 215,423 wounds in the American Expeditionary Forces, there were about 25,000 fractures, and of these, 15,165 were of the long bones. Thus far there have been reported 906 cases (6%) of non-union.

Of these, 611 were treated by bone grafts; 189 by Lane plates; 52 by suture with wire, and 54 with kangaroo tendon or chromic catgut.

The author concludes that it is reasonably safe to operate during the fourth month after complete healing. Autogenous grafts taken from the tibia have proven the best material for fractures of the long bones. Exact coaptation is necessary for success.

In the cases that have been rated for disability, 48% had 25% disability or under, 22% had between 25% and 35% disability, and 22% had between 35% and 50% disability. In 8% the disability was over 51%. Figures show that where the interval between injury and operation was less than two hundred days, a low disability of 25% was obtained in 43% of the cases; whereas it was obtained in 57% where the interval was over two hundred days.—*P. D. Wilson, Boston, Mass.*

NON-UNION OF HUMERUS: REPAIR BY MEANS OF BONE GRAFT. M. S. Henderson. *Southern Medical Journal*, February, 1921.

This study is based upon forty-one cases of non-union of the humerus. The cause of the non-union is stated to be imperfect immobilization in ambulatory splints. The author feels that his method of operative procedure and after-care is efficient. The author reviews the theories of osteogenesis promulgated by Ollier, who maintained that a graft without its periosteum died; by Radzimonsky, who contended that all transplanted bone dies, but that periosteum lives and may form bone; by Barth, in 1893, who advanced the theory that all the elements of bone die when grafted and that the graft is a scaffolding for the replacement of bone by the bone forming elements of the raw fractured ends of the parent shaft; by Axhausen; by Macewen in 1912, who regarded the periosteum as a living and limiting membrane; all these investigations that osteoblasts, wherever they be, under the periosteum, in the haversian canals, and especially in the exposed endosteum, are the means for completing the union and possible replacement of the graft with and in its bed; that periosteum, by establishing a speedy vascular connection, otherwise impossible, nourishes the graft while the process of internal reconstruction is going on. The osteoblasts are most abundant in the endosteal surface of the bone, and therefore there ought ideally to be wide apposition of endosteum to endosteum, and the graft must be sufficiently strong to withstand reasonable strain until the condition is wholly cured. For these reasons and because the massive graft satisfies him, the author advocates its use as against the intramedullary peg of Murphy, which is fundamentally wrong in principle, and the Albee inlay method, which does not supply a sufficient endosteal counterposition of bone elements. His statistics show 85% of good results with the massive graft; 70% with the inlay; 50% with the intramedullary graft. There is nothing new in the method of exposure; the graft is held by beef bone screws. A plaster jacket with arm in abduction is applied on the operating table, to be replaced in four to six weeks by an ambulatory, internal angular metal splint, depending upon the clinical evidence and x-ray examination.—*W. A. Cochrane, Boston, Mass.*

NEWS NOTES

DR. CLARENCE L. STARR of Toronto has been appointed Professor of Surgery at the University of Toronto and Surgeon-in-Chief to the Toronto General Hospital.